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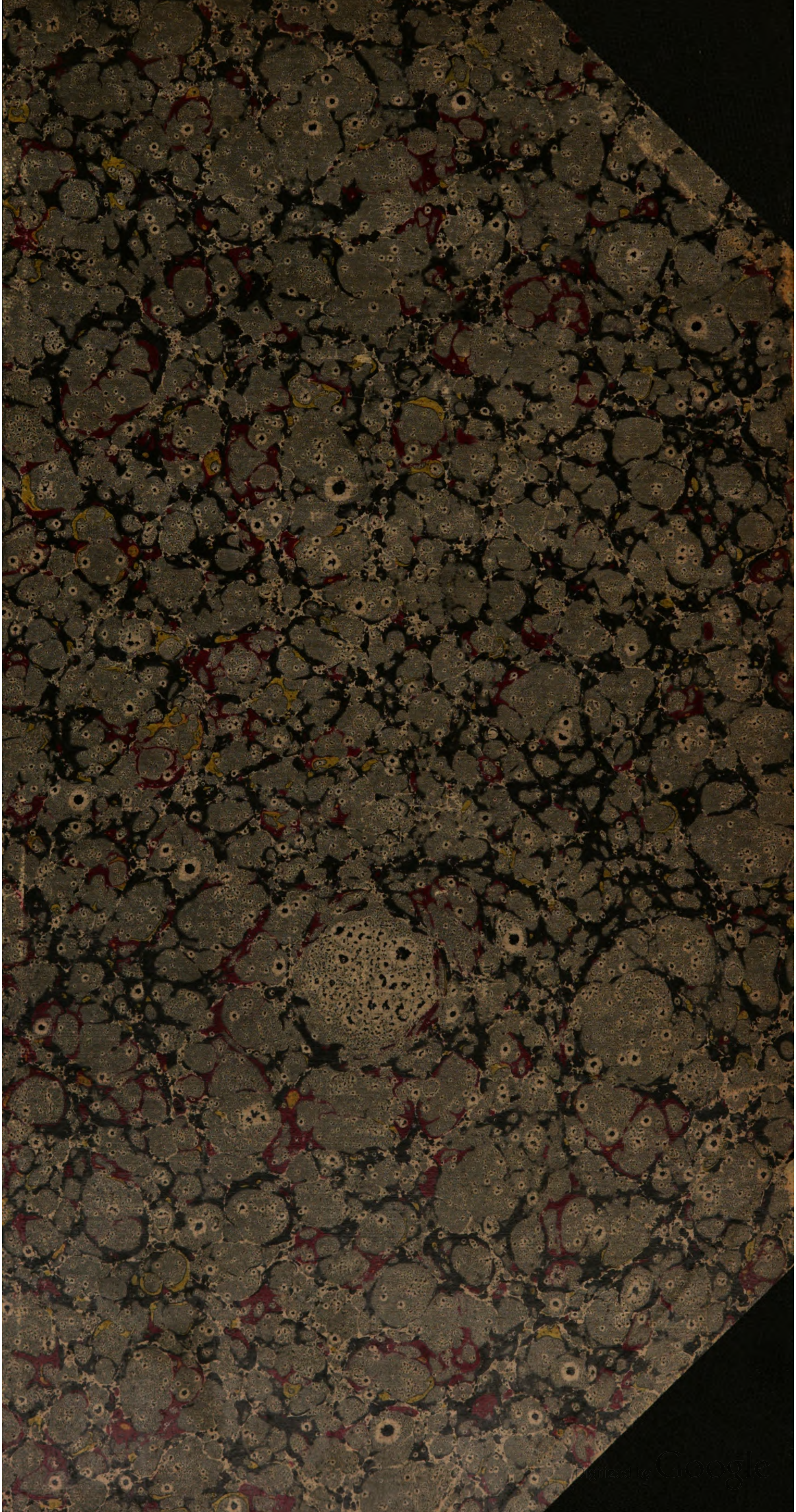

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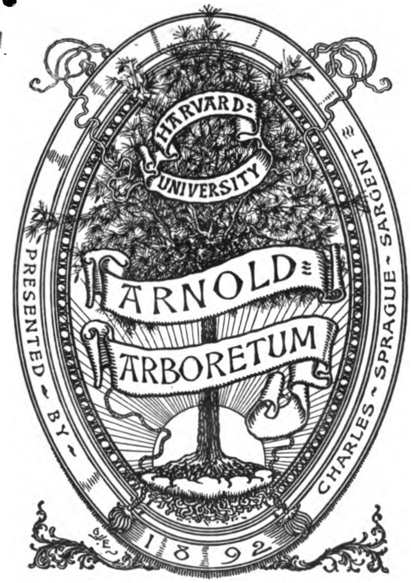

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NEW COMMERCIAL PLANTS AND DRUGS.

No. 6.

PART I.

FIBRES: THEIR BOTANICAL SOURCES; THE METHODS OF EXAMINING THEM UNDER THE MICROSCOPE, AND THEIR TREATMENT BY THE EKMAN PROCESS—*Illustrated with Six Coloured Plates.*

PART II.

NEW PLANTS AND DRUGS: THEIR CULTIVATION AND USES.

By THOS. CHRISTY, F.L.S.

WITH THE KIND ASSISTANCE OF M. VÉTILLART, OF PARIS.

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PREFACE.

The question is often asked me, "Is a certain Bark or Grass of any value for Paper making, or for obtaining a fibre?" for "the Natives beat out small quantities of it and produce beautiful fabrics."

I had decided that this question should form a part of No. 5, but when working at it, the invention of Mr. Ekman was introduced to me, and I found that much of the work I had commenced, and the data which my friend Mons. Vetillart, the greatest authority upon fibres in Europe, had assisted me to collect, would have to be re-arranged and modified. Mr. Ekman and the firm with which he is associated, have for more than fifteen years been experimenting with a view to improve, for the purpose of paper making, the quality of fibre that is obtained from the White Fir *(Abies)*. This subject having been worked out by a production of over a thousand tons of wood pulp a year, and this wood pulp being manufactured into paper in England, and sold in the trade, has proved what can be done with pure cellulose made from wood. This one fact established enabled me to state at once why it was useless to search for vegetable fibres to compete against this wood pulp, when suitable wood can be obtained.

In this book I show how sufficient wood to produce one ton of paper can be transported to this country and sold at £4, whereas esparto grass comes at over *four* times the money.

This process of Mr. Ekman's opens up an entirely new field for our Indian possessions, by enabling us successfully to solve the question of the preparation of fibre for spinning and weaving purposes. The oldest records show that the mode of treatment of fibres by the Natives has been known, but the quantity they can produce is so small, that it is quite useless to think of exporting it to this country.

Again, they cannot be pressed for a greater quantity, because it is produced at such a slow pace, and then only worked during the "wet monsoon," when the Natives cannot work in the fields.

The raw fibres which I have had treated by Mr. Ekman shew that they are entirely amenable to the Bi-sulphite of Magnesia treatment, and produce a material which is valued at from £110 to £115 a ton here.

Another most interesting question will shortly be solved, and that is, by the Ekman process the fibre can be reduced to its normal condition; so that, for instance, if Hemp or Flax be boiled for a sufficient time under pressure, the other necessary conditions being carefully fulfilled, and the fibre be then well washed in water, the cuticle, woody and encrusting matters are entirely disintegrated and removed, and the pure normal fibre remains in such a condition that it may be treated exactly in the same manner as Cotton.

It may be known only to very few residents in Great Britain that Flax and Hemp can be produced here in this state very much below the price of Cotton, and yet samples shewn here have been valued at such prices that if I were to quote them, they would be hardly credited; so that we not only have a new operation for English Agriculturists, but also we have an immense field open for treating magnificent foreign fibrous plants that will yield a material quite equal to silk in utility and beauty.

Another interesting fact has been established, and that is, that Cotton machinery can be utilized for spinning this normal fibre, which can actually be produced at a lower price than in the form of filaments as at present used by linen manufacturers.

There is no doubt that many of the plants that can be obtained at a low price will be turned into paper pulp, and very likely in some instances the long fibre will be utilized for spinning, while the short residue is employed for paper, for with this process the fact is established that everything that has been tried up to the present time that is known to contain a fibre has yielded to the action of Bi-sulphite of Magnesia. Even cocoa-nut husks in one hour yielded their fibre, so that it could be drawn out by the hand as soon as it was sufficiently cool.

The plates in this book have been prepared by Mons. Vetillart, who has kindly assisted me with his immense experience and extraordinary skill as a draughtsman of microscopic subjects. I find that hardly a day passes but what someone asks me, "Do you think such and such fibre would be useful for paper or for spinning?"

My object in publishing this work, and the information furnished by Mons. Vetillart, is to set at rest this question by enabling anyone having a microscope, to test for himself any fibre that comes before him, and I have classified the leading fibres under those for paper making, for spinning, and for cordage. The scope for paper making may run from the highest standard of Japanese packing paper, which is more like a web, and is a paper that can be made into clothes, and may go down to writing paper, which can be made almost equal to parchment, and have a surface given to it such as is scarcely known in rag paper. For spinning materials, no one can predict which plant will be found to yield the best fibre, because by most of the old processes the cellular structure, or cellulose, has not been properly cleared of the encrusting matter, and some of the fibres are ruined by "retting," and others seriously weakened by bleaching, all of which is done away with by the new process, one operation yielding a perfectly pure fibre.

With regard to cordage and ropes, the best raw materials for which cannot yet be defined, suffice it to say that fibres having all the necessary varying characteristics can be obtained. The cable and ropemaker can select the produce of different plants according to his requirements for an absorbent substance, or one that is light and will float on the water; the former being made up of long cells like flax and hemp, and the latter having an altogether different structure, like the fibres of coir and aloe. In the case of the threadmakers, they will be able to utilize the finest normal fibres, and spin them like Sea Island cotton.

In future numbers of "New Commercial Plants," it is my intention to revert to this subject of fibres from time to time, as more information is obtained.

I am indebted to the Director of the Royal Botanical Gardens, Kew, for sundry specimens of palm leaves and known fibre-yielding plants, grown in the houses at Kew. At the same time, I received specimens from Mr. T. Hanbury, of Mortola; when these green leaves were boiled a sufficient time, the former yielded a most delicate weak cellulose, and those grown in the open air on the shores of the Mediterranean gave a firm form of cellulose.

At present it is necessary to treat flax and hemp under different systems for the sake of varying the fibre that is required. For instance, the stem is cut green before the seed is ripe, consequently this part of the crop is lost. The object, as far as I can learn, is that in "retting" the filaments separate differently.

The result, as far as it is ascertained by the Ekman process, is that the best fibre is obtained from the ripe plant or stem; if this turns out to be the case, the grower will be able to ensure a good return by the sale of the seed, and at the same time secure a brighter fibre. Take another view, viz., that of a farmer. Cotton is imported from America and other places, and costs here for a quality with a long fibre 6d. per lb., that is to say, £56 per ton. Flax costs raw £20 per ton, so add for chemicals, labour, and Royalty, £10 per ton, the cost would then be £30. You have for this price a fine normal fibre that can be spun and woven, mixed with wool felted into cloth, or twisted into sewing thread.

The process is so simple for producing the normal fibre, the skin and woody parts readily wash off, leaving a beautifully white silky residue, which is pure cellulose or normal fibre.

The treatment of the roots cut from the flax will pay all the expenses by the yield of low-class fibres for paper making.

In drugs, the most striking advance has been that of Papaw and Papaine. Prof. Rossbach has not yet published the work which he has in hand, and I am not surprised at his extending his researches with this important drug.

I am glad also to be able to record the fact of some of our English surgeons working on this, and that they have been much surprised at the results they have obtained. It is hoped that some of the profession who make a speciality of the throat, will experiment with Papaine and publish their results.

LYCOPODIUM TINCT. (*Lycopodium clavatum*) is most harmless even in the hands of Natives or inexperienced people. It is too early yet to say anything about its effect in outward applications, but as far as the trials have gone, such interesting and important results from its use have come under my notice, that I have felt it my duty to make them public, as I have not been able to find any published reports.

CHAULMUGRA OIL (*Gynocardia odorata*) is now becoming a drug of everyday use, and large quantities of the fruit are being carefully collected in India. I should be glad if anyone in the East could give me any particulars as to the medicinal properties of the fruit, and if they know of its being turned to any account by the Natives, for I see by works that have been sent me, that the employment of this Oil has been known in India for centuries. It was one of the medicines or embrocations used after battles to cure sprains and wounds.

TONG-PANG-CHONG, which has before been alluded to by me, has not been found by Mr. Malcolm Morris to give good results in Ringworm.

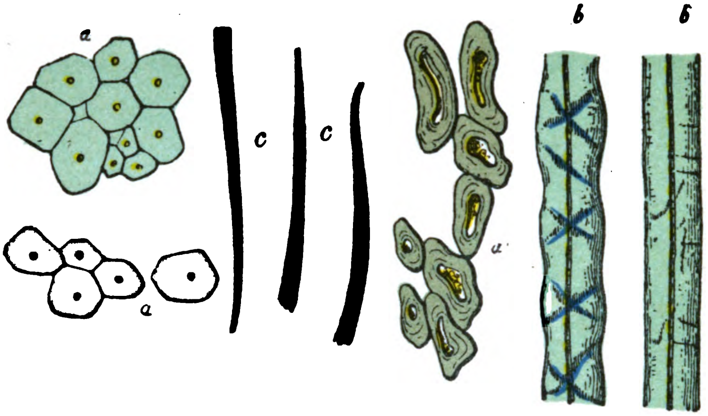
I shall be glad to receive samples and specimens of drugs from abroad that are known to the Natives to produce certain actions upon the skin, as there are several physicians and surgeons who are willing to try their effect.

THOS. CHRISTY, F.L.S.

July, 1882.

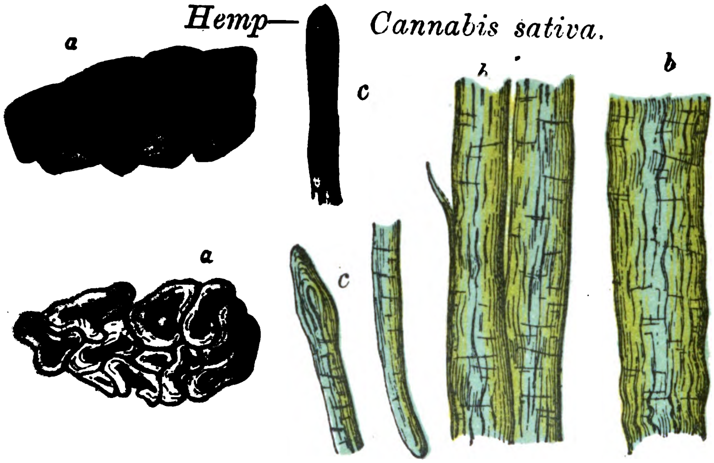
Flax—Linum.

Fig. 1



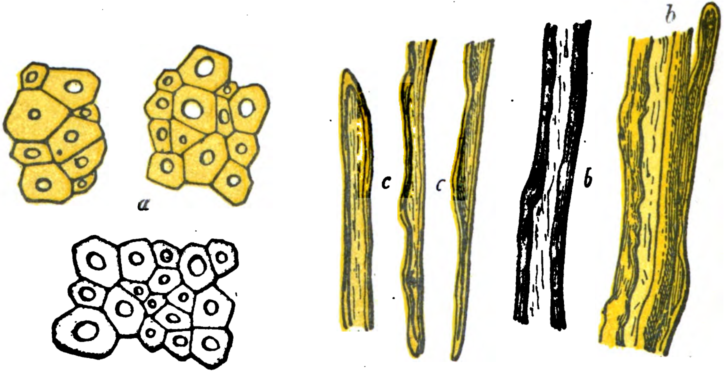
Hemp— Cannabis sativa.

Fig. 2



Jute—Corchorus capsularis.

Fig. 3



NEW COMMERCIAL PLANTS & DRUGS

No. VI.

ON VEGETABLE FIBRES PRODUCED IN TROPICAL COUNTRIES.

Note.—All the figures of the annexed plates have been drawn with the camera at a uniform scale of 300 diameters, by Monsieur Vetillart.

I.

Vegetable fibres are used in three different kinds of manufacture:

1. Rope Making (including cables and strings), which requires strong fibres, capable of resisting the alternation of heat and moisture. These fibres may be coarse, but they must unite the two conditions of tenacity and resistance to the influence of climate. They require a certain degree of flexibility, so that they do not break when the fibres are bent at a sharp angle. This quality is necessary to avoid the breaking of a rope at a knot when a sudden jerk or a strain is applied to it. For cables, other qualities are sometimes required; for instance, the fibre should be apt to absorb tar. Lightness is a requisite that is likewise much looked for. Cables made of Manilla hemp are sometimes so light that they swim on the water. This arises, very likely, from the hollow cells of the fibres, which are filled with air and give a certain buoyancy to the whole fabric.

2. Yarns and Woven Tissues. — Yarns being finer than ropes or strings, require peculiar qualities for the fibres of which they are made. These fibres should be of a certain length, more or less fine, according to the nature of the yarn that is to be made from

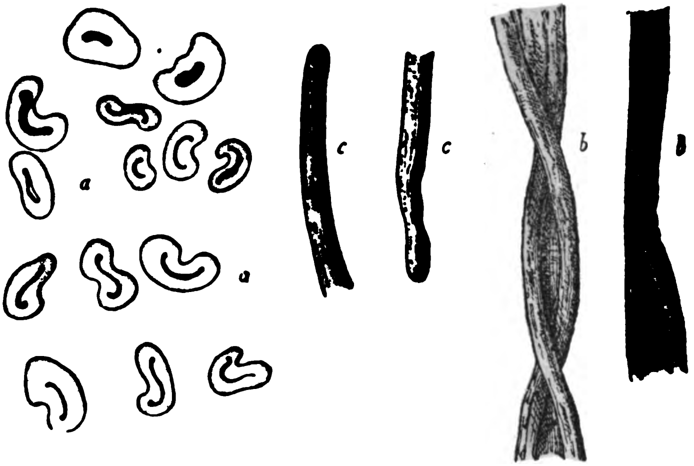
them. They should possess what is called the spinning quality, that is, a glossy surface that allows them to slide smoothly one against the other when they are drawn through the teeth of the gills or combs of the roving or spinning frame. The parallelism of the fibres is necessary to obtain the ribbons, which become gradually thinner and narrower till they are fit to receive the final twist. This last operation gives a closer texture to the fabric, and this twisting of the fibres together hinders them from sliding and separating from each other when a certain traction is applied to the yarn. It results from these observations that to obtain a yarn of a certain tenacity, the ultimate cells that compose the fibres by their agglomeration, should be very flexible and of a certain length; otherwise the twist given in spinning would have no efficacy to hold together these cells when the substance, by means of which they are agglutinated, is destroyed by bleaching or frequent washing. They part from each other, in that case, when they are too short to be entangled by twisting. Length, flexibility, tenacity and parallelism are the necessary requisites for fibres that are intended to be converted into yarn or cloth. The last requisites are sometimes met where the first is wanting. For instance, yarn of a tolerable appearance may be made with jute, the cells of which are only 2 or 3 millimetres long, but when yarn or cloth made of that material is kept for a certain time in a wet state, it can be broken or torn with the greatest facility, because the short cells of the fibre become disengaged.

3. PAPER MAKING.—Paper is produced by the felting together, while they are in a wet state, of fibres which are generally very thin and short, and have a curly disposition, so that they catch each other and become entangled; hence the tenacity of paper, for this tenacity is not due to the solidity of the fibre itself. If a small fragment of rag paper be examined under the microscope, after having been reduced to the state of pulp with water, it presents the appearance of a mass of fibres, cut very short and torn, so that these stumps of cells are more or less decomposed into smaller fibrils, which terminate, each of them, like the curly end of a worn-out paint brush. This decomposition into curly fibrils facilitates the felting we have considered as the characteristic of our paper.

This peculiar disposition is to be looked for in all the fibres proposed to supersede the common rag in paper making. They must possess it to a certain degree to be fit for that purpose, otherwise they can be used only as a sort of filling up.

Cotton—Gossypium.

Fig. 1



China Grass— —Bœhmeria nivea.

Fig. 2

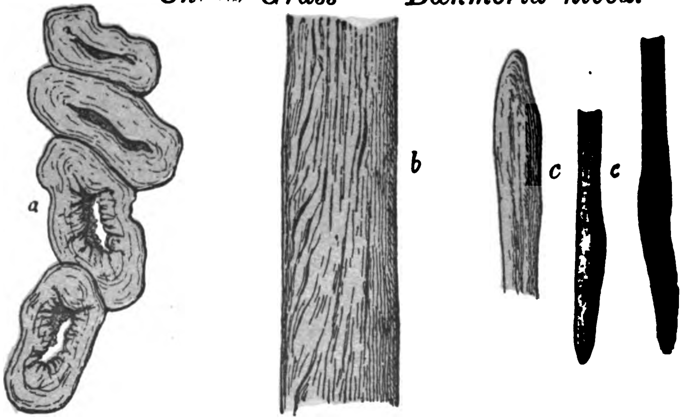
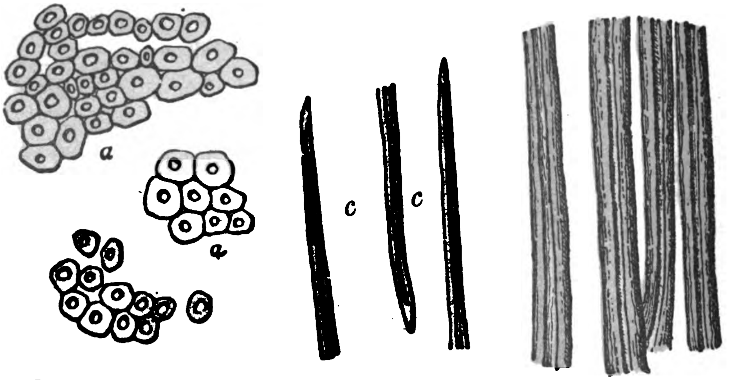


Fig. 3



New Zealand Flax—Phormium tenax.

II.

The vegetable fibres used for the different kinds of manufactures we have mentioned, are of three kinds.

1. Those produced by the dicotyledons are contained in the bark of the plants of that great division They are disseminated in a parenchymatous tissue, in the shape of cords or long bundles of cells, sometimes called *bast,* but more generally designated under the name of *fibres.* They are seldom independent; in most cases they separate from each other and unite again to form a sort of network. This is well seen in the lace bark tree.

The ultimate cells which by their agglomeration produce these cords or fibres, are fusiform, that is, tapering to a point at each end. They consist, when they are young, of a sort of bag formed by a thin membrane, and filled with a liquid. In the process of vegetation the walls of the bag become thickened by successive layers of cellulose; the empty space is gradually reduced. Sometimes this central space disappears, and the cells become completely solid. These cells overlap each other, and are united by a substance, the exact nature of which is not yet well defined.

The substance that composes these cells is cellulose, more or less pure. When it is pure the fibres are flexible, and have a great tenacity. But the cellulose is often lignified, that is impregnated with foreign matter which renders the cells stiff and more or less brittle.

By the successive action of iodine and sulphuric acid it becomes possible to ascertain the degree of purity of the cellulose of which the cells are composed. When it is free from any admixture, the cells take a blue or purple colour, under the action of these re-agents, but they assume a bright yellow colour when they are lignified.

Their length varies in enormous proportions. For instance, in jute that length varies from 1 to 5 or 6 millimetres; in flax and hemp the average is 30 to 40 millimetres. The cells of China grass (*Bœhmeria nivea*) reach habitually 100 to 150 millimetres. We have observed single cells of a Bœhmeria fibre that attained the extraordinary length of 250 millimetres (10 inches).

2. The fibres produced by the monocotyledons are generally contained in the leaves. They exist there in the shape of parallel cords, more or less thick, generally round, of pretty uniform diameter in the same individual, and running through the whole length of the leaf. The cords are formed by the agglomeration of cells varying

much in diameter in different plants, but usually much shorter than those of the dicotyledons. Most of them are lignified, and consequently stiff and brittle. The central cavity is sometimes very large; in that case, the walls of the cells being rigid, they keep their form and do not collapse like those of the dicotyledons, which, in drying, become flat like a ribbon when the walls are thin and the diameter of the cell relatively large.

It is moreover to be noticed that when the plant is fresh, the fibres of the monocotyledons are easily separated from the cellular tissue by which they are surrounded. Although they are in most cases strongly lignified, it is easier to obtain them under the form of white and silky fibres, than can be done with the dicotyledons, but they are generally less flexible and more brittle than those of the latter.

3. The third sort of fibres found in the vegetable kingdom, and used by human industry, are *hairs* that play a certain and definite part in the plant. They surround generally the seed to which they are attached; they protect it, and facilitate its transport from one place to another by the aid of the wind or of animals.

These fibres are independent one from the other. They can be used directly by human industry, without necessitating those delicate and costly operations, without which the two other sorts of fibres cannot be isolated.

COTTON is the most remarkable type of this class of fibres. Its cells, as represented in Plate II., Fig. 1, A A, are sections made across the cells, showing their rounded forms, and relatively thin walls; B B represent the body of the cell, often twisted like a ribbon; C C are the ends opposed to that by which they are attached to the seed of the plant. This is what we propose to call a normal fibre.

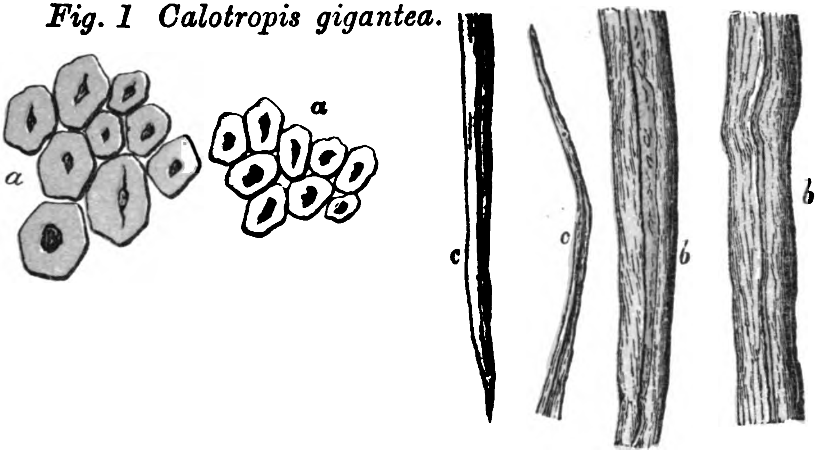
III.

FLAX AND HEMP are the fibres of the first class that stand pre-eminent in Europe. The plants that produce them develop themselves slowly in our temperate climates; the fibres have time to acquire a certain maturity, the cells are often completely filled up, and possess that flexibility and tenacity which give them a great superiority over all those commonly used in Western Europe. These qualities are made apparent by the Figs. 1 and 2 of Plate I.; Fig. 1 represents in B the body of the cell of flax; that on the left is drawn from a cell that has been bruised between the

Pl. IV.

Mudar Bark.

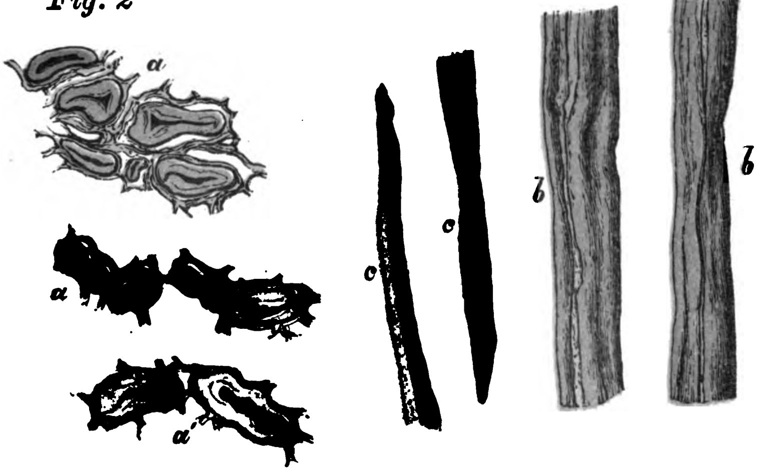
Fig. 1 Calotropis gigantea.



Paper Mulbery.

Broussonetia papyrifera.

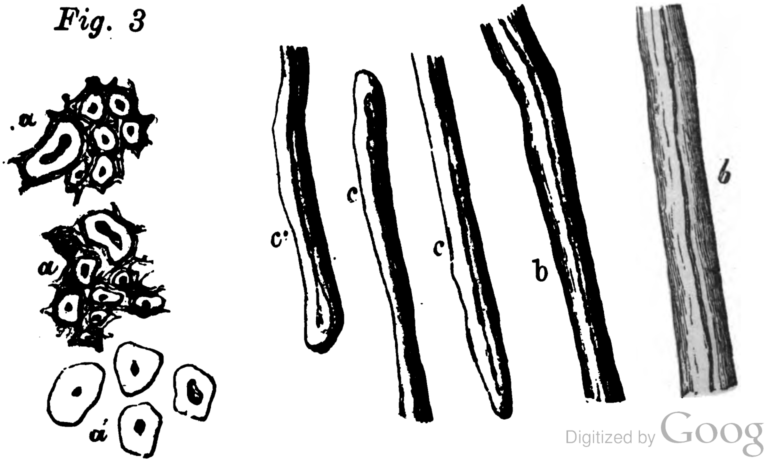
Fig. 2



Nepal Paper Plant.

Daphne papyracea.

Fig. 3



fingers before the re-agents have been applied, and gives the explanation of those knots which several authors have mentioned as existing in the fibres of flax; C C, are the points of the cells; A A, sections cut across the fibres show the form of the cells and the great thickness of their walls; A represents sections of the fibres situated near the root of the plant. These last are torn and separated during the process of heckling, and are mixed with the tow, so that when such sections are met with in flax yarn, one may be sure that it contains tow, and is not made with the core of flax or pure line.

Fig. 2 represents the cells of hemp.

The same plants grown in the warmer climates of India produce fibres of a decidedly inferior quality.

URTICACEÆ.

Tropical countries produce with more perfection the different varieties of *Bœhmeriœ* (China grass) particularly the *Bœhmeria tenacissima* (Rami of the Malays, Rhea of Assam, Kalœ of Sumatra). This plant cultivated in a warm and damp climate contains a fibre much superior in several respects to that of flax or hemp. Its cultivation would certainly be advantageous in the whole Indian Archipelago. Fig. 2, Plate II. shows the cells of the *Bœhmeria nivea*; B the body of the fibres, the large size of which may be appreciated by comparison; A, sections of the cells. These have a great analogy with those of hemp and the *Urticeœ* in general, but they are much larger.

To those who wish to have more details on this valuable fibre, I recommend the work of Forbes Royle on the vegetable fibres of India. I beg likewise to refer them to "Etudes sur les Fibres Textiles," by Monsieur Vétillart, where most of the fibres mentioned here are treated of in a more complete manner.

ASCLEPIADACEÆ.

Two plants of this family deserve to be mentioned; the *Calotropis gigantea* and the *Marsdenia tenacissima*, the fibres of which present all the qualities of the finest flax. Some difficulties have presented themselves in isolating the fibres from the bark. That question has not been examined yet, but it will be of great importance for Mr. Ekman to give some attention to it.

The Fig. 1, Plate IV. represents the fibres of the *Calotropis gigantea;* A A are sections showing a great analogy of forms with those of flax. The central cavity is larger, but the walls are thick and develop a blue colour under the action of iodine and sulphuric acid. This is an indication that the cellulose of which they are composed is quite pure. The body of the cells seen in B B is smooth but less regular than in flax. The central cavity contains a granular substance that takes a yellow or brown colour. The ends C C are generally thin and terminate in a long and slender point.

The extreme lengths of the cells are 5 mm. and 50 mm., the average 16 mm.

The diameters vary between 0·011 mm. and 0·040 mm.

A variety from Pegu which we have seen gives the longest fibres.

TILIACEÆ.

JUTE is a fibre produced by several varities of *Corchorus* which grow in tropical countries. But we shall speak of it only to deprecate the use of the fibre which is too often introduced fraudulently in European manufactures. It may be used for some particular kinds of webs, but it should be proscribed from all kinds of cloths that are exposed to moisture. The tissues that contain jute fibre, as at present treated, can neither be bleached, nor washed without losing their tenacity.

The cells of the Jute are represented in Fig. 3, Plate I, A A sections of the cords or bundles of fibres in which the cells are tightly adhering to each other; B the body of the cell, and C C the ends.

MORACEÆ.

It is known that in Japan, paper is used for a variety of purposes, even for curtains and ladies dresses. The tough and soft paper used in manufacturing these is made with the cortical fibres of the *Broussonetia papyrifera* or *Paper Mulberry.*

The bark of this tree is very rich in fibres, the characters of which may be appreciated by inspection of Fig. 2, Plate IV. The forms of the cells have a great analogy with those of cotton. They are separated from each other by a thick parenchymatous tissue and can be easily isolated. The cells are generally flattened and ribbon-like. They measure from 50 to 20 millimetres. Their diameter varies between 0·02 mm. and 0·03 mm. These fibres are certainly fit to make a very superior quality of paper.

A A, Fig. 2, Plate IV. are sections taken from *tapa cloth* made in the Indian Archipelago by beating the bark of the Broussonetia

Pl. III.

Alfa or Esparto—Stipa tenacissima.

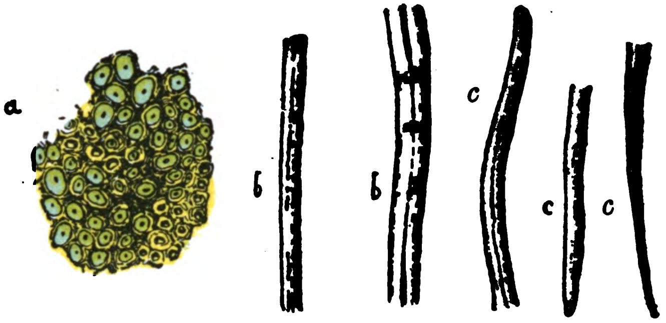


Fig. 1

Pita—Agave Americana.

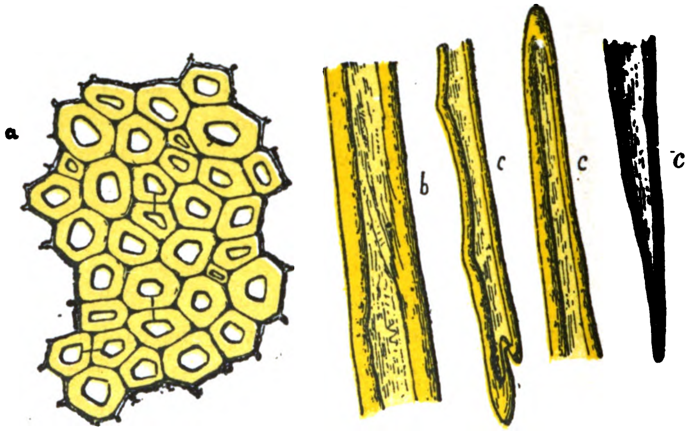


Fig. 2

Manila Hemp—Musa textilis.

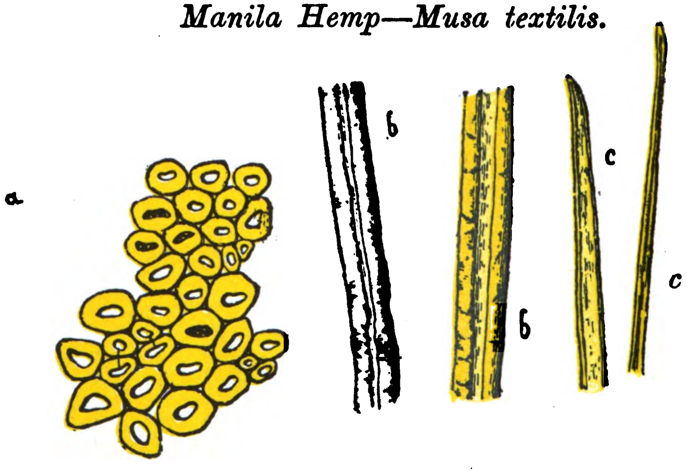


Fig. 3

flat and smooth with mallets; A is drawn from the bark of the same plant grown in France; B B body of the fibres; C C the ends or points.

THYMELACEÆ.

We have had occasion to examine a kind of vellum given as a produce of Japanese industry, and used sometimes in Europe for engravings. Wood engravings printed on such paper have certainly a very superior appearance. It is made with the bark of the *Daphne papyracea* or *Nepal paper plant.*

The cells are very fine; the diameter varies from 0·007 mm. to 0·017 mm. Their average length is 4 or 5 mm., the extremes 3 mm. and 6 mm.

Fig. 3, Plate IV. shows the cells of the *Daphne papyracea*; A A are the sections; B B the body of the fibres; C C the points; A are sections of the cells of the *Lagetta lintearia*, a plant of the same family very rich in cortical fibres.

Tropical climates are particularly favourable to the growth of fibre producing plants that belong to the class of Monocotyledons or Endogens. It is to these that attention should be chiefly directed.

MUSACEÆ.

We shall mention first the *Musa textilis*, the fibres of which are now in great request, under the name of *Manilla Hemp*, for the cables and ropes used in the navy. The cables made of that fibre are of a fine light colour; they are strong, remarkably light and they can stand the alternations of heat and moisture better than hemp or flax which under such circumstances soon become useless by decomposition. Manilla hemp reaches very high prices in European markets.

In Plate III., Fig. 3, are represented sections of the fibro-vascular bundles of *Musa textilis* (A A); B B is the body of the cells which are rounded and smooth; C C are the points. The cells are longer than those of Jute, they reach 10 to 15 millimetres.

LILIACEÆ.

Fibres of analogous quality might be obtained from different varieties of *Sanseviera*, particularly the *Sanseviera Zeylanica.* They are held in high esteem by the natives of Ceylon, and are considered remarkably strong.

Fig. 1, Plate V. represents the cells of the *Sanseviera Zeylanica*

The sections A A show that the walls are very thick; B B the body of the fibres; C C the ends or points.

Length of the cells 1 mm. to 6 mm., diameter 0·01 mm. to 0·026 mm.

The *Phormium tenax* attracted the attention of Europe several years ago; it has since disappeared from our markets. Yet it deserves better treatment. Not only is it an excellent material for ropes, but its softness, silky lustre and great tenacity would certainly make it fit for certain kinds of tissues.

The cells of the *Phormium tenax* are to be seen in Fig. 3, Plate II. These cells are extremely fine and their walls relatively thick. Their length, averaging from 10 to 15 millimetres, give to this fibre a great superiority over Jute, by which it has been replaced to the great bane of the consumers; A A are sections of fibro-vascular bundles; B B, the body of the fibre, that is round, smooth and regular; C C, shows the sharp points.

The *Agave Americana* produces a strong and white fibre called *Pita,* used in tropical America for ropes and fine basket work. It is coarse and stiff, but it may offer certain advantages for particular purposes, such as carpets, and for coarse yarn and fillings. See drawings of the cells in Fig. 2, Plate III.

BROMELIACEÆ.

The fibres of the plants of this family deserve particular attention. Some of them possess a tenacity and softness which would certainly permit their use, like flax, for fine tissues. These fibres treated with iodine and sulphuric acid, as we shall explain further on, acquire a blue or purple colour; this is very rare among the fibres of the monocotyledons. It shows that the cells are formed of cellulose nearly pure, or only slightly lignified. The plants of the *Bromeliaceæ,* the fibres of which are used by the natives in tropical countries, are *Ananassa sativa, Bromelia Pinguin, B. Karatas, B. Pigna, &c.*

The inspection of Fig. 2, Plate V., will show the fineness of the fibres of the *Ananassa sativa,* or common *pine apple,* drawn on the same scale as the other fibres (300 diameters). A, is a portion of a fibro-vascular bundle contained in the leaf; B B, the fibre; C C, the points.

The length of the fibres varies between 3 mm. and 9 mm. The diameter is about 0·006 mm. The extremes being 0·004 mm. and 0·008 mm.

Pl. V.

Tucum Palm.
Astrocaryum tucuma.

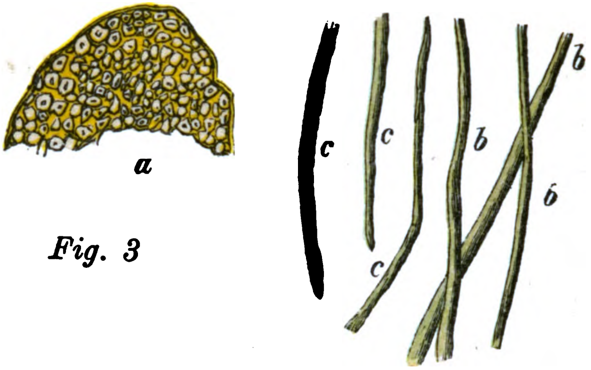
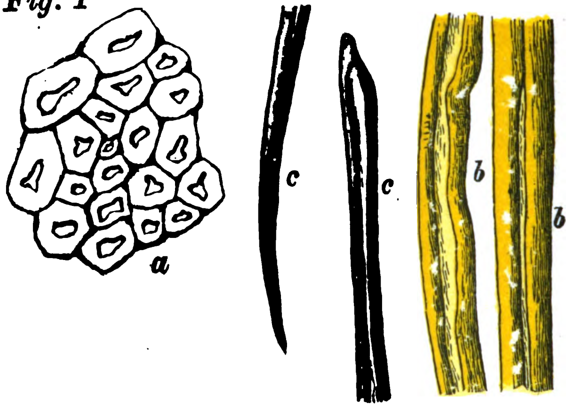


Fig. 3

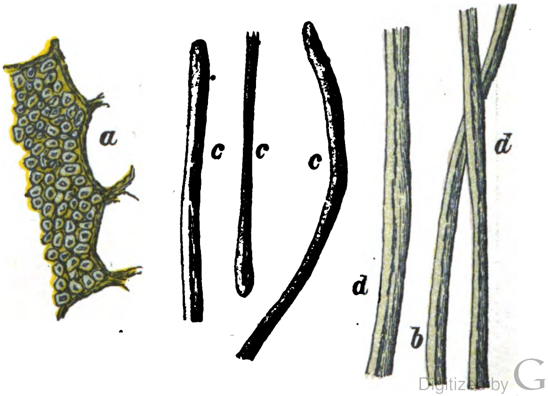
Bowstring Hemp.
Sanseviera Zeylanica.

Fig. 1



Pine Apple.
Ananaſsa Sativa.

Fig. 2



GRAMINACEÆ.

We cannot leave this class of plants without speaking of the *Alfa*, or *Esparto grass*, so much used now, particularly in England, for paper-making. Two *graminaceous* plants produce this valuable fibre—the *Stipa tenacissima* and *Lygeum Spartum*. Either of them are cultivated; both are found in immense quantities on the high grounds of North Africa. Alfa may be considered as the type of plant fibre most suitable to supersede rags in the manufacture of paper. Its cells are remarkably fine and short (1 to 3 mm.), and they have a tendency to curl, which facilitates the felting disposition observed in the web of our papers. Besides, they are of great regularity and nearly solid, presenting scarcely the appearance of a filiform cavity in their centre. The only merit over wood pulp is that these fibres absorb printing-ink more rapidly.

Fig. 1, Plate III., shows at A, sections of these cells, closely packed up, they form the main body of the sound and tough leaves which look like the stem of a rush; B B is the body of the fibre, and being drawn to the same scale as the other fibres represented, it is easy to observe how fine it is; C C are the points of the cells.

Alfa, or *Spanish grass* as it is sometimes called, such as is imported into England, gives 50 per cent. of available fibre for paper-making.

PALMACEÆ.

We find that in the great *Palm* order, the *Elaïs guineensis* and the *Mauritia flexuosa* give fine, soft, and tenacious fibres. They might, probably, be used either for yarns or even for cloth, like the *Ananassa sativa*.

To show the nature of the fibres that might be obtained from some members of the palm family, we give (Fig. 3, Plate V) drawings of the cells of the *Astrocaryum Tucuma*, or *Tucum Palm*—A, is a portion of a fibre-vascular bundle of the leaf; B B, the cells; C C, the points.

These remarkable fibres have a mean diameter of 0·006 mm., the extremes being 0·005 mm. and 0·008 mm, They are rather short. The length varies from 1·5 mm. to 3·5 mm. They have the greatest analogy with those of *Mauritia flexuosa*, *Raphia tædigera*, and *Elaïs guineensis*, but they are much finer than any of these.

Most of these fibres would make excellent paper stuff if they could be brought to our markets in a state of sufficient purity to avoid the expense of carriage on useless stuff, and at prices that might compete with that of the pine wood.

MICRO-CHEMICAL EXAMINATION OF VEGETABLE FIBRES.

I have given a brief indication of the qualities required for fibres applicable to the uses I have enumerated. When a new fibre is introduced, it is very important to determine its value and the kind of manufactures to which it can be applied. The general appearance, the softness and fineness of the filaments, their tenacity and their divisibility may be appreciated at once without the use of any instrument; but to ascertain the length of the cells, their diameter, the state of purity of the component cellulose, their stiffness or their tendency to curl, and consequently their aptness to be felted, the thickness of their walls, and the form of their points, it becomes necessary to have recourse to more delicate operations. The microscope is the instrument used for that purpose, and the observer should be prepared to understand its indications. The characters I have mentioned are most important in determining the uses to which the fibres may be applied.

I intend to show, briefly, how this end can be attained:—

To avoid unnecessary detail, we will suppose that the person who intends to follow these instructions is already familiar with the use of the microscope.

The instruments required for a complete analysis are:—

1.—A dissecting microscope or a mounted lens, to enable the observer to separate the fibres and spread them on the slide. Aplanatic lenses, magnifying ten times, are to be preferred for this purpose.

2.—A compound microscope of a magnifying power of about 300 diameters. It should possess a micrometric eyeglass.

3.—A scale, divided in centimetres and millimetres, on a slip of plate glass, longer and larger than a common slide.

4.—A small hand-vice, the jaws of which are bored so as to form a cylindrical hole of about 3 or 4 millimetres in diameter.

5.—Dissecting needles, plyers, slides, covers, &c.

6.—A small porcelain mortar, with a boxwood pestle.

The chemicals to be procured are the following:—

7.—A solution of iodine prepared by dissolving 1 part of iodide of potassium in 100 parts of distilled water, and adding iodine till saturation. It should be kept in a glass-stoppered bottle, and fragments of iodine left at the bottom to ensure constant saturation.

8.—Sulphuric acid diluted with glycerine—3 parts in volume of sulphuric acid, of specific gravity 1·84, are mixed carefully (to avoid sudden heating) with 1 part distilled water and 2 parts pure glycerine. The mixture is allowed to cool and to settle; the clear liquid is then decanted in glass-stoppered bottles.

9.—A solution of 1 part in weight of dry crystals of carbonate of soda in 10 parts water.

10.—A solution of 1 part caustic potash in 6 parts of water.

11.—A small bottle of pure glycerine. Price's glycerine does very well.

A definite weight of the fibres to be examined is boiled for half-an-hour, at least, with carbonate of soda (9), adding water as it evaporates. When cold, the fibres are drained, and then beaten in a porcelain mortar with a wooden pestle (6). After some time, water is added, and the fibres rubbed with the pestle under water. The liquid is then poured in a large tumbler or other glass vessel covered with a piece of very fine brass wire cloth. The turbid water passes through it; the fibres and foreign matter not sufficiently bruised remain on the wire cloth. The drained mass of fibres remaining in the mortar is again beaten with the pestle, rubbed under water, and drained over the wire cloth. Now and then, the matter remaining on the cloth is scraped off and thrown in the mortar. These operations are repeated till the water coming out from the fibres, after beating and rubbing, runs nearly clear. The whole is then thrown on the wire gauze, well drained, scraped off and dried completely. It is then exposed to the air to allow it to regain its hygrometric water.

If this operation has been done with care, the residue contains nothing but the fibres isolated from the adhering parenchymatous tissue. It is then weighed, and the proportion that the fibres bear to the raw material that has been operated upon, is ascertained with sufficient approximation.

The fibres are then examined lengthwise under the microscope. A few fibres, prepared as we have described, are placed on a slide with a drop or two of iodine (7). When they are well impregnated with the liquid, a few drops more are added, and with the aid of the dissecting microscope (1), and the needles (5), the fibres are divided as well as possible, so as to isolate the component cells. When these cells are separated and spread on the slide, the liquid is absorbed by means of square bits of thick white blotting paper,

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about 2 centimetres wide. When the preparation is well drained, three or four pieces of clean blotting paper are placed carefully, one above the other, on the fibres, taking care not to displace them; the blotting paper is then pressed with a smooth ivory paper knife, rubbing gently at first, then with a certain pressure, until all the excess of moisture is taken from the fibres.

A drop of sulphuric acid (8) is then deposited upon them, and a thin glass cover placed on the whole. The drop of acid is caused to spread under the cover by striking gently this last with the handle of the needle. When this is done, the preparation is ready to be examined under the microscope (2).

If the fibres show a blue or purple tint, the cells are composed of pure cellulose, and are flexible and tough, but if their colour is yellow, it indicates that they are more or less lignified or impregnated with nitrogenous substances which render them more or less stiff and brittle.

If the iodine solution and the sulphuric acid have been properly prepared, the fibres are not in the least altered in their forms, and the colorations obtained allow the most delicate characters of form and texture to be visible, and strike the eye more clearly than when a neutral liquid is used. The thickness of the walls of the cells, their dimensions, and the form of their central cavity, can likewise be more easily appreciated. It is possible then to know if this cavity is empty (Figs. 2 and 3, Plate I.), or if it contains a foreign substance, which appears then with a yellow or brown colour (Fig. 1, Plate I, Figs. 1 and 2, Plate II, Fig. 3, Plate III.)

It happens sometimes that the cellulose of the cells is so close or hardened, that the fibres do not take any colour at all. In that case a few drops of caustic potash (10) are placed on a slide, and the refractory fibres, in a dry state, well impregnated with the liquid, and *immediately* dried with several folds of blotting paper. Iodine is then applied. It loses its colour at first, but fresh drops are added till the yellow tint of the iodine neither fades nor disappears. If this operation be performed with care, the colour will appear as soon as sulphuric acid is applied. If the colour is too deep, or if the cells seem to swell and lose their characters, a new preparation should be made, taking care to add a little water to the caustic potash on the slide before introducing the fibres. A little practice will soon show how this operation should be conducted.

The characters thus observed are generally sufficient to give an idea of the form of the fibres, and of the nature and relative thickness of the walls of the cells. If it be necessary to go further into this sort of analysis, and to obtain more complete information concerning the form and texture of the cells, then thin sections made across the fibres perpendicularly to their axis must be prepared. This requires a little practice. We shall now describe how these sections are to be obtained.

The fibres are glued together so as to form, when dry, a sort of stick of about the size of a small wooden pencil. It is necessary that the glue should become sufficiently hard in drying to give a great stiffness to the little stick thus obtained, and yet it should be soft enough to be cut with a razor like a piece of wax, or like a horny substance. Besides, it should dissolve completely in the iodine, so as to be entirely removed with the liquid that is absorbed by the blotting paper. I prepare this glue in the following manner:—

70 Grammes of clean white gum arabic are dissolved in the same weight of *cold* distilled water. 4 grammes of isinglass are allowed to soak and swell in 16 grammes of cold water. Then heat is applied so as to dissolve it. The solution of isinglass is filtered, while hot, through a piece of fine muslin. When the *first half* of the thick liquid has filtered through the cloth, it is added to the solution of gum arabic, and the rest thrown away. The whole is then heated in a water bath, and 10 or 12 cubic centimetres of pure glycerine are added. The ingredients are well mixed together and poured into glass bottles with large necks, containing each about 30 to 40 cubic centimetres. A small piece of camphor is dropped into each bottle, to hinder the formation of mildew.

This glue becomes solid on cooling. Before using, it should be melted in a water bath, or simply by placing the bottle near the fire. It should be used hot, while it is in a fluid state.

A small bundle of fibres, of the thickness of a wooden pencil, and about 3 centimetres long, is cut in the sample, and firmly tied at one of its ends with a stout thread. The part that remains free is impregnated with the glue, then drawn and dressed between the fingers so as to form a sort of stick, in which the fibres are parallel, and as close as possible to each other. The glue is then allowed to dry; the little stick hanging by the thread. Twelve hours at least are necessary to give it a proper consistency or stiffness, so that it may be cut across with a razor without giving way.

The stick or rod thus obtained is placed in the cylindrical cavity of the small hand vice (4), and with a sharp razor (a narrow blade is to be preferred) thin shavings are detached at right angles with the axis of the rod. It requires a certain practice to obtain these chips or shavings of a proper tenuity. If they are too thick, the sections of the cells thus obtained are of no use, and can give no indications.

The shavings are gathered on a slide, with a small drop of iodine, with which they are well mixed, so as to form a thick paste; a few drops more of iodine are added, so that the sections can swim in the liquid, and the slide is placed for a few moments near the fire or above the flame of a candle, to heat slightly the mixture and facilitate the solution of the glue. Small squares of thick blotting paper are then placed on each side of the large drop of liquid, so that their sharp and clean edges just touch the iodine, which should be absorbed slowly. Care is to be taken that the liquid does not rush too quickly towards the blotting paper, carrying with it the sections, which might attach themselves to the paper and be lost. The imbibition should be slow, and the two pieces of blotting paper made to slide towards each other on the glass, carrying before them the sections, so as to form, in the middle of the slide, a sort of ridge, on which fresh bits of blotting paper are applied to complete the absorption of the moisture by rubbing with a paper knife, as we have explained above.

A small quantity of iodine is dropped again on the deposit, and the same series of operations repeated, to insure the complete solution and removal of the glue.

A drop of sulphuric acid (8) is then let fall on the ridge that remains, and which has been well dried with blotting paper; after mixing with the point of the needle or any other tool, a thin glass cover is applied, and the whole is made to spread on the slide by striking gently the cover with the handle of the needle.

The preparation is now examined under the microscope (2). The small sections of fibres lying flat on the slide, show then the exact form of the cells, the thickness of the walls, the form and relative dimensions of the central cavity.

These sections are either blue or purple (pure cellulose), or yellow (lignified cellulose).

These indications complete all that requires to be known about the cells.

It is of great importance to ascertain the length of the cells. The slip of plate glass on which a scale is engraved (3) is used for that purpose. A layer of pure glycerine is spread on a slide, which is placed upon the glass scale, and the whole is laid on the platform of the dissecting microscope (1). A small quantity of the fibre to be measured is placed in the glycerine and spread so that the cells are as straight as possible. Each of these cells are well separated, and extended at full length; the viscosity of the glycerine facilitates the operation. When it has been ascertained that a cell is whole and completely isolated, its length is taken by means of the transparent scale placed under the slide.

This operation is repeated on a certain number of cells, according to the degree of approximation required.

Note is taken of the extreme lengths and of the average.

Instead of glycerine, the glue, of which we have given the recipe, may be used with advantage sometimes, but it should be diluted with its volume of water.

The diameter of the fibres is measured with the aid of the ocular-micrometer. This operation requires a certain practice in the use of the micrometer, but it is to be remarked that it is of much less importance to know the diameter of the cells than to ascertain their length.

M. VETILLART.

To ascertain the presence of woody encrusting matter in cellulose, the best tests are sulphate of aniline and nitric acid. The best preparation of sulphate of aniline is a saturated alcoholic solution. If paper or cellulose be moistened with a drop of alcoholic solution of sulphate of aniline, a very small percentage of woody matter will produce a yellow stain; a drop of nitric acid produces a brown color. If the cellulose is perfectly pure these tests produce no change of color. Pure cellulose also dissolves in sulphuric acid, and produces a solution which is colorless.

CHEMISTRY OF VEGETABLE FIBRES.

There can be no longer any doubt that chemistry has opened up a new field for the chemical manipulation of certain fibrous plants, by which splendid fibres can be obtained for weaving. Hitherto the idea has generally been to seek for paper-making material, but when this book becomes better known, and it is understood that few, if any, fibrous plants can compete with wood fibre for paper-making,* and the fibre of different plants has been practically tested by chemical action, to shew their fitness for spinning, a great change will take place.

People living abroad must bear in mind the fact that almost the highest price that can be obtained for a paper pulp in this country is £20 per ton, without any of the short stuff or filling in it, whereas for a fibre for spinning into cloth no limit can be placed upon the price, for the simple reason that the demand for any good fibre that would turn out a beautiful cloth, similar to the hand-made cloths from the Philippines, would fetch a price equal to that of silk. Mere chemical tests are not always to be relied upon; thus, when experiments were made with bi-sulphide of carbon, immense strides were anticipated, but it was found that 40 per cent. of extraneous matter surrounding the fibre was not acted upon by this chemical, whereas by Mr. Ekman's new process not only the extraneous matter surrounding the fibre is removed, but also the incrusting matter inside the tube of the fibre, thus leaving the tubes of pure cellulose completely empty.—(See Plate VI, Fig. 2.)

The operation of the chemist can greatly be assisted by the producer by cultivation, and also by crossing the varieties of the plants. It is also known that certain plants in India grow better in the wet weather—for instance, the "Agave vivipara;" whilst in the dry season the "Taaeg," or "Crotalaria juncea," does better, the fibres being found to make more durable ropes and better canvas.

The price in India of the highest class of fibrous material is only about 4s. a maund. This shows at how low a price the raw material can be obtained; but on the other hand there is no doubt, if the new process is taken up energetically in England, it will have to be superintended abroad by Europeans, and the first stages of the operation must be completed where the plants grow. When it is known that 1200 tons of chemically treated fibre are turned out from one factory in the course of a year, of which the

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* For printing and writing papers.

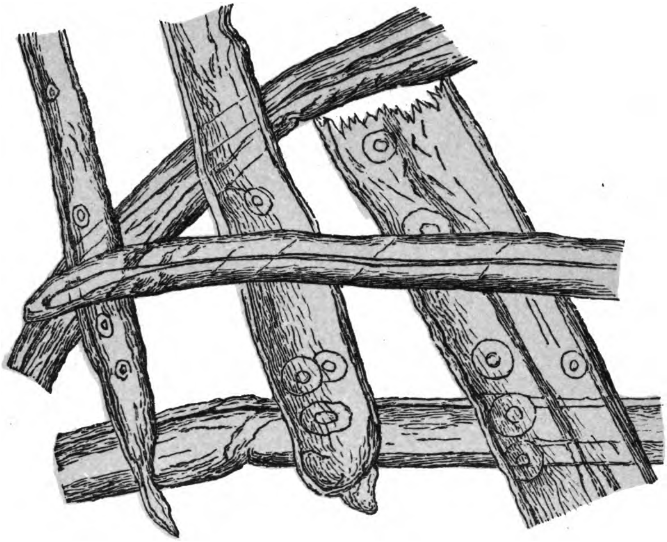

Fig. 1

White Fir.
Abies.

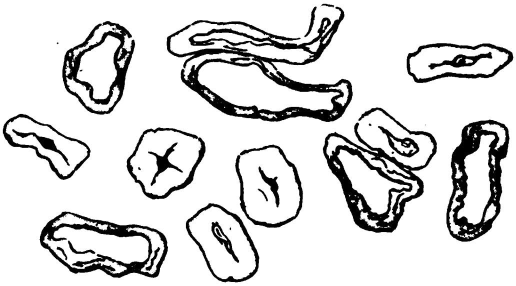

Fig. 2

greater part has been regularly brought to London and converted into paper, it must be admitted that this is no theoretical question, but is based upon commercial principles.

Pandanus Vacao affords an instance of a plant which yields a valuable fibre from its leaves, but which, up to the present time has not been successfully treated by chemicals, therefore if a small quantity were sent by the sample post, it would be interesting to try the nature of the fibre for spinning. The natives of Mauritius are said to produce from it a fine elastic cloth. Particular attention should be paid to this point by residents abroad who may read this book, because, although certain fibres may have been sent home to be tested, and may have been reported to be too short and poor, notwithstanding the fact that good cloth is produced from them by the natives, yet now it is quite probable that a long fine fibre may be easily obtained by this new chemical process from the same plant, which, if treated by the old fashioned plan of first soaking it, and then retting it, would have yielded a broken and spoilt fibre, quite useless for spinning purposes.

Since many of the pages of this book were first penned, the invention of Mr. Ekman has been brought prominently before the public, and it would therefore only be misleading if the results and conclusions were not clearly placed before our readers. With this view, the following reasoning upon facts and figures will be very acceptable to numbers of people who are surrounded by what they believe to be good paper making materials.

RAW MATERIALS.

The primary consideration in the selection of a raw material for paper making is its first cost.

Those fibrous plants which are capable of producing textile fibres are too expensive for this purpose, although their fibres eventually find their way to the paper maker in the form of rags.

Apart from these, the raw materials which are available in any considerable quantities are:—Esparto and plants of the same family. Straw and Wood.

The quantities of these which are required to produce a ton of paper-making cellulose (reckoned dry) vary slightly in different samples, but they may be taken on an average at:—

Esparto, &c.	45 cwt.
Straw	45 ,,
Wood	200 cubic feet.

Taking the average price of esparto at £7 per ton, of straw at £2 per load (40 trusses of 36 pounds), and of wood at £4 10s. per cubic fathom, the first cost for a ton of dry cellulose will be :—

	£	s.	d.
Esparto	£15	15	0
Straw	7	0	0
Wood	4	3	4

TRANSPORT AND WAREHOUSING.

The next point to be considered is the cost of transport of the raw material to the paper mill. In this respect all the advantages are on the side of wood, for where water carriage is available, it can be floated to the mill at a trifling cost. Whether carried by railway, or by other land carriage, the compactness of wood must give it an advantage over esparto, and again esparto must have a preference over straw. In fact the cost of moving the latter material any considerable distance is so great, on account of its relative volume, that its use must be confined to paper mills situated in a district where it is plentiful.

Of the three materials the stack of wood in the open air is the smallest and covers by far the least ground, is in the least danger from fire, and is less liable to suffer by exposure to the weather than the other two.

CONSTANCY OF SUPPLY.

One of the most important considerations to a manufacturer in erecting plant for the treatment of a raw material is that his plant shall not be rendered useless by the failure of supply of the raw material.

There can be no doubt that, if not already, at least in the immediate future, it must be acknowledged as a first principle of agriculture that all straw grown on the farm shall be returned to the soil in the shape of manure; therefore, any one erecting a paper mill and reckoning on the regular supply of straw must calculate such a sinking fund as shall extinguish his capital account in a very few years. Straw is already becoming so excessively dear in this country that even now any regular supply at a moderate price cannot be counted on. With esparto the case is somewhat different, but there are "rocks ahead" with this raw material which cannot fail to influence both the price and the supply. The diminution of sailing-ships and the substitution of steam tonnage goes on from year to year with rapid strides. The quick despatch required by the latter mode of transport makes it unsuited to esparto cargoes. Then the old fields must become exhausted, and new sources of supply must be found farther from the shipping ports. This means increased cost of collection and transport.

That the supply of wood for paper making is practically inexhaustible may be judged from the fact that the imports into the United Kingdom during 1881 from Europe alone may be taken in round numbers at about five million tons, besides the nearly equally large imports from Canada and the United States. There is not the smallest ground for believing that the supply of this raw material will ever fail. And the kinds of wood best suited for paper making are those least suited for other purposes, and consequently realizing the lowest prices in the market. The cost of sending forward wood to the shipping ports must always be less than that of other raw materials. It has only to be thrown into the streams, and the floods of spring impel it by natural means towards the mouths of the rivers. As a consequence the extension of the field of production has comparatively little influence in raising the cost.

CLEANLINESS OF THE RAW MATERIAL.

The great enemy of the paper maker is dirt. Every speck of dirt in the half-stuff becomes multiplied in the beaters, and disseminated through the paper.

With rags the paper maker introduces dust and dirt in every form (and often even disease) into his mill.

The more sub-divided the raw material the more it is apt to carry dust and dirt in its interstices. The loose bundle of straw (under similar circumstances) must collect more foreign matter than the bale of esparto compressed by hydraulic power.

But the log of wood can only collect dirt on its outer surface, which is easily washed and cleansed. Its interior is always absolutely free from dirt or foreign matter. So that the paper maker has in wood alone a raw material which, with ordinary care, is absolutely clean.

PREPARATION OF CELLULOSE.

The modes of preparation of cellulose from fibrous plants up to the present time have been remarkable only in this, that they have followed in different ways one single idea :—oxidation. In the rettin of flax, hemp, and jute, whether performed in the most primitive way, or by modern methods, the greater part of the effect is doubtless due to oxidation. Then we have exposure, in a damp state, to air and light, treatment with chlorine and its compounds, and boiling in alkaline solutions : all processes of oxidation. When it was desired to obtain cellulose from straw and esparto, boiling under pressure with caustic alkali was resorted to, a more severe oxidizing process than had hitherto been used, and wood could only be treated by using the strongest solutions and an extreme pressure. It would be surprising indeed if the strength of the fibre itself did not suffer by such treatment as this.

This one idea of oxidation did not take its origin from any theory that an oxidized form was that in which vegetable incrusting matters were originally soluble. It had simply been handed down from barbaric times as the only mode of preparing pure cellulose which was practicable. While it is evident that the incrusting matters are carried to the positions which they occupy in plants in a soluble form, there is not the least reason to believe that they contain more oxygen when in solution than when solid. The reverse is more probable.

As the bulk of these incrusting matters doubtless consists of the isomerides of starch and cellulose, it seems far more probable that their change from a liquid to a solid form is a physical and not a chemical one.

As boiling in water has a tendency to render starch and its isomerides soluble, boiling seemed to be a proper step in rendering these incrusting matters soluble.

In order that any effect could be produced on so dense and compact a material as wood, boiling under pressure was necessary. But when the pressure and heat reached such a point as to be effective, oxidation also began and rendered the attempt abortive.

It then occurred to Mr. C. D. Ekman that if the oxidation could be prevented while the boiling was carried out, perfect solution of the incrusting matters could be attained.

After years of study and experience a practical method of carrying into effect this rational mode of operating has been discovered, and the results are no less interesting from a scientific, than valuable from a commercial, point of view.

EKMAN'S PATENT PROCESS

Consists in subjecting fibrous plants to boiling under pressure in water containing so much sulphurous acid, more or less in combination with an alkali or base as shall be necessary to prevent the oxidation of the organic matter.

For perfect success the base must be such as forms tolerably soluble compounds with sulphurous acid. Of these the most available are potash, soda, and magnesia. Of these potash is the dearest, and magnesia by far the cheapest. In other respects also magnesia is admirably adapted for the purpose. It has therefore been principally chosen by Mr. Ekman for his process.

The exact proportions required depend upon a variety of circumstances; the density of the raw material and the consequent pressure required, the constituents of the raw material, and the extent to which it is required to remove the incrusting matters. The knowledge of some general laws enables the operator to judge to a nicety the exact proportions and the extent of boiling necessary to produce a desired result with certainty and economy.

WOOD AS A SOURCE OF PURE CELLULOSE

Hitherto pure cellulose has been obtained from wood only with great difficulty, but Mr. Ekman succeeds in producing from the raw wood at one operation a cellulose practically pure. The organic matter which it contains when well washed is so small that it fails to give the characteristic reaction of wood with sulphate of aniline, and may be dissolved in sulphuric acid with little change of colour, Under the microscope it is seen that the fibres are altogether freed from incrusting matter, while their form and brilliancy are perfectly retained. At a cost for chemicals of not more than about £3 per ton of dry cellulose, a material can be obtained (direct from the boiler), requiring only to be washed in water to be suitable for the manufacture of good printing papers. Further bleached by the ordinary methods, this material produces all the finest papers for printing, drawing, and writing. There is no essential difference between this cellulose and that obtained from flax, and it is impossible for any expert to determine (without the aid of the microscope) which papers are produced from wood and which from linen. At the same time if it is required to produce a material for wrapping or brown papers, it is necessary only to diminish the pressure and quantity of chemicals.

We have now therefore a means whereby with the greatest economy and certainty we can produce at will from wood every kind, from the coarsest wrapping to the finest writing paper.

PRODUCTION OF TEXTILE FIBRES.

The principles on which Mr. Ekman's discovery are based are applicable not only to wood, the most difficult source of cellulose, but also to plants which yield the different forms of cellulose with greater facility, *e.g.*, jute, hemp, flax, esparto, straw, &c.

The product from the last two plants differs from the ordinary material only in being somewhat stronger and more free from organic matter. The cost of the product is only about one half of that prepared by means of caustic soda. But a great advantage is that the pollution of streams from caustic alkali and decomposed vegetable matter is entirely avoided, for the refuse from this process is innocuous.

It is not possible to foresee what will be the effect of this invention on the industries where jute, hemp, and flax are employed. It is remarkable that cotton is the only fibre which has hitherto been spun in the ultimate or normal fibre.

In the spinning of flax, hemp, and jute, filaments (*i.e.*, isolated or ultimate fibres, held together in sheaves or bundles by a gummy or agglutinating matter) are used. Then by the bleaching process this agglutinating matter is afterwards removed partly in the yarn, and partly in the cloth, so that linen loses about 18 to 20 per cent. of its weight by bleaching in the yarn, and from 3 to 5 per cent. by the final bleaching in the cloth. At first sight this appears a remarkable proceeding, and one would suppose that if ultimate or isolated fibres could be produced with ease and without weakening the fibre, jute, hemp, and flax could be spun like cotton from the ultimate or isolated fibres. By Ekman's process either filaments or isolated fibres can be produced direct from the straw, but whether it may be found eventually advisable to send to the spinner the one or the other, nothing but experience can enable us to judge. It seems more than probable that hemp may in the future rival flax as a textile in the production of fine cloths.

BY-PRODUCTS FROM THE MANUFACTURE OF CELLULOSE

Whatever opinion may prevail as to the methods of preparing cellulose hitherto in use, it must be readily admitted that the fibre has been obtained at the expense of the other constituents of the plant. Whether the process has been putrefactive fermentation, boiling in alkaline solutions, or other modes of oxidation, the effect has been the actual destruction of the constituents of the plant, the cellulose alone remaining unaltered.

Now, as no known plant contains more than about 50 per cent. of dry cellulose, the destruction of organic matter which goes on annually is something enormous, and the cost of destroying it by the expensive means employed no less considerable.

It has been already mentioned that the bulk of this matter consists of isomerides of starch and cellulose, and, as obtained from wood, it resembles dextrin and glucose in some of its properties. It is, however, without effect on a ray of polarized light. Besides this most interesting material, which can be prepared in enormous quantities, there are in smaller quantity other by-products of no less interest to the manufacturer and the scientist. Formic and acetic acids, volatile oils and other constituents of plants and trees, invite their study and attention.

No more promising field than this has been opened to the chemist since the discovery of aniline and its derivatives; and the results are likely to prove no less valuable to commerce than to science, not only in bringing into view vegetable matter hitherto but little known or altogether unknown, but probably also in giving a clearer insight into the secret processes of plant life.

Information has just been sent to me that the paper factory in Jamaica has been closed and machinery sold off, as the supply of bamboos failed. When the stems were cut they did not shoot again, and the natives now suffer from the loss of one of their most useful vegetable products. Government ought to prevent the extermination of the bamboo in granting concessions.

There are many machines now offering that force out the gum and juice from the aloe and other stems. This enables a much larger quantity of raw fibre to be placed in the cylinder. The Ekman process renders the fibre white, and other machines may be required for freeing the normal fibre from the woody particles.

Full particulars of all machines and systems that yield good results are collected by me, and I shall be glad to receive any information on new inventions.

BOTANICAL DESCRIPTION.

It is well known that plants belonging to the two great divisions — *Dicotyledons* and *Monocotyledons* — possess fibre of different characters, and that certain orders, or families of plants in these two divisions are especially characterised as fibre-yielding groups, while others yield none. I propose, therefore, to assist those who cultivate, or live near, fibrous plants, but who are not well acquainted with botanical science, by giving briefly and concisely the leading characters by which the chief fibre-yielding families are distinguished, so that other plants than those already known may be sought for, and experimented upon, in foreign countries.

The plants belonging to the *Dicotyledons* are distinguished, as a rule, by having four or five parts to the flower, and by the smaller veins in the leaves forming a network, as in the Lime or Linden tree.

In *Monocotyledons*, on the other hand, the parts of the flower are usually three or six, and the smaller veins of the leaves run parallel to each other, as in grass or Banana.

The chief fibre-yielding families of *Dicotyledons* are as follows :—*Linaceæ, Malvaceæ, Tiliaceæ, Leguminosæ, Urticaceæ, Cannabinaceæ, Moraceæ, Thymelaceæ*, and *Salicaceæ*.

Of the *Monocotyledons*, the following families are the most remarkable for containing fibre:—*Graminaceæ, Bromeliaceæ, Liliaceæ, Juncaceæ, Amaryllidaceæ, Musaceæ*, and *Palmaceæ*.

The fibres yielded by plants of these orders, when subjected to the action of sulphuric acid and iodine, become coloured either blue or yellow. Those which assume a blue tint are composed of nearly pure cellulose, are more supple, stronger, and generally longer than those which take a yellow coloration. The latter are rigid, very short, and brittle, especially when drawn from a knotted bundle of fibre.

DICOTYLEDONS.

Of the *Linaceæ*, or Flax family, the common flax may be taken as the type. The plants of this order are small plants, with smooth, undivided, stalkless leaves, and the coloured part of the flower, which consists of five separate pieces, quickly falls off; the stamens or threads in the centre of the flower are about five in number, united at their base, and have intermediate abortive ones between them. The seeds are oval and smooth.

The *Malvaceæ* have flowers more or less resembling the common mallow or hollyhock in shape, the five coloured portions of the flower being united at their base to a tube formed by the numerous stamens, whose filaments are joined nearly all the way up, the anthers, or bags containing powdery pollen, being free from each other, and kidney-shaped, and one-celled. Most of the plants of this order are herbs or shrubs with stalked leaves, yielding a mucilage to boiling water, and having a fibrous bark, which is very difficult to break. The seeds are usually kidney-shaped.

The *Tiliaceæ*, although nearly allied to the *Malvaceæ*, bear very little general resemblance to that family, except that the principal veins of the leaves radiate from the leaf-stalk, and that the leaves have stipules (*i.e.*, smaller additional leaves at the base of the leaf-stalks). The flowers are usually small, and the stamens, which are numerous, are *not* united to one another. Jute in India, and the Linden Tree *(Tilia Europœa)* in this country may be taken as types of this order.

The *Leguminosæ* are chiefly distinguished by the fruit being a pod, and by the flowers, as a rule, bearing a strong resemblance to a pea-blossom in shape. Sunn hemp *(Crotalaria juncea)*, which has yellow flowers like the common broom, is one of the best fibre-yielding plants of this order.

The *Urticaceæ*, or Nettle family, have small inconspicuous green flowers, which never form catkins, and leaves furnished with hairs and usually with stings. The leaves are often opposite to one another, and are furnished with stipules. The flowers have no coloured row of leaves, and the fruit only contains one seed. To this family belongs the *Rami,* or China "grass" or Rhea plant, and also the Neilgherry nettle—*Urtica heterophylla.*

The *Cannabinaceæ*, or true Hemp family, differ but little from that of the nettle order, except that the leaves are usually lobed and alternately placed on the stem, and have a rough surface, but are without stings. The flowers, like those of the *Urticaceæ*, are small and greenish, and are without coloured leaves, and the fruit consists of a single seed. The rough-lobed stipulate leaves of the hop will give some idea of the character of plants of this family.

The *Moraceæ*, or Mulberry family, differ from the two last in having a more or less milky juice, and in the flowers being collected into small heads or catkins, which are of two kinds—male and female, the male catkins dropping off after flowering. The plants of this order are mostly trees or shrubs, unlike the last two, which are mostly herbaceous. The fibre is chiefly contained in the inner bark, that of the Paper Mulberry (*Broussonetia papyrifera*) yielding one of the most valuable fibres known for paper-making.

The *Thymelaceæ*, or Daphne family, consist chiefly of shrubs or small trees with an exceedingly tough bark. The leaves are never divided, are usually without stalks, and alternately placed on the stem. The flower consists of one row of four or five (usually coloured) pieces, which are united into a tube below. This tube has either one or two rows of stamens attached to its inner surface, each row corresponding in number to the coloured leaves of the flower.

The *Salicaceæ*, or Willow family, are mostly shrubs or trees with more or less elliptical stalkless leaves, having a bitter taste, and flowers or catkins appearing before the leaves, the male and female catkins being on different plants.

MONOCOTYLEDONS.

Of the fibre yielding plants belonging to this division of plants the Plantain, or Banana family (*Musaceæ*) are distinguished by their large sheathing leaves; the blade is oblong, and has a large prominent vein, with a number of smaller ones at right angles to it. The substance of the leaf being softer than in the Palms, the leaves are often torn into lateral strips. The sheaths of the leaves are very long, and form a sort of false stem by overlapping and enclosing each other. The flowers are arranged in a long drooping spike, and are enclosed in large bracts. The plants of this family are chiefly tropical or sub-tropical.

The *Bromelixceæ*, or Pineapple family, have usually narrow rigid channelled leaves, spiny or prickly, but with margins differing from those of the Aloe and Agave in being less fleshy, and in having the upper surface more concave; the flowers are generally rather showy.

The Southern, or Spanish Moss (*Tillandsia usneoides*) used as a substitute for hair for upholstery purposes, belongs to this family.

Liliaceæ—This order contains a large number of fibre-yielding plants, of which the more important belong to the genera *Phormium Sanseviera* and *Yucca*. The flowers have six coloured parts, and are usually showy, and contain six stamens. The seed vessel is not visible below the flower. The leaves are undivided, but vary much in size, consistence, and shape.

Juncaceæ.—The plants of this family, of which the common Rush may be taken as a type, differ chiefly from the *Liliaceæ* in their leaves being usually cylindrical and thread like, and in the flowers being small, greenish, and chaffy in character.

The fibre of *Juncus maritimus*, a rush abundant by the sea coast almost all over the world, yields, under Mr. Ekman's process, a fibre that promises to be of some value.

Amaryllidaceæ.—The plants of this family have usually more or less fleshy leaves, which are either flat or slightly concave, and arise in a tuft from the root, or from the top of a short stem. The flowers resemble those of the lily family, from which they are distinguished solely by having the seed vessel visible beneath the flower. By this latter character the Agave is distinguished from the true Aloe, which it much resembles.

Palmaceæ.—The plants of this order are mostly trees, with simple unbranched trunks, and large terminal leaves, either furnished with lateral leaflets, or fan-shaped. The flowers are arranged on a terminal or lateral branched stalk, enclosed at first in a large sheathing bract. The flowers are comparatively small, and of different sexes, the female flower being succeeded by a one-seeded fruit, enclosed in a coat, which is often fibrous. Of this family the Cocoanut Palm may be taken as the type.

MALVACEÆ.

Hibiscus tiliaceus.—This fibre, called *majagua* in Central America and the West Indies, is much used for cordage. It is little affected by moisture, and is, therefore, selected by surveyors for measuring-lines. It is the *Bola* of Bengal, and is found throughout tropical and subtropical regions of both continents.

Abutilon Avicennæ.—Indian Mallow.—This has been cultivated in the United States to a limited extent. It is an annual, usually growing to the height of 4 feet, though in cultivation stalks of 6 feet high are common, and Professor Waterhouse records a height of 8 feet in Missouri. It grows freely upon any rich soil, even thrusting itself in and growing spontaneously,

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so that it has almost come to be considered a farm pest in many portions of the country. It grows luxuriantly throughout the West and North, the line of States from Ohio to Missouri producing even now vast quantities of the fibre, which rots and goes to waste upon the stalks every year. Mr. Lefranc considers it superior to Indian jute, and finer than Manila hemp, and he classifies it, in value, between Manila and Italian hemp.

Extracted from the plant in its young stage, it would be fine enough for textile fabrics, such as carpet yarns and fillings. It takes readily any colors, and its natural lustre displays more in the aniline dye than in any other, a great advantage over Indian jute, which is antagonistic to cheap bleaching and dyeing.

Fully ten years ago it attracted considerable attention in the West, and particularly in Illinois, through the endeavours of Mr. J. H. McConnell, who demonstrated its value by manufacturing it into thread, cordage, rope, &c.

In the last two years it has been the special subject of investigation and experiment in the State of New Jersey, through the endeavours of Mr. Samuel C. Brown. A circular was issued in 1878 for the twofold purpose of awakening an interest in the subject of fibre cultivation, and to ascertain what portions of the State were best adapted to its cultivation. From their investigations and experiments, it is settled that there really need be no difficulty in fibre cultivation, the material point being to ascertain the best conditions under which to convert hitherto uncultivated plants into those of future industrial significance and profit. Mr. Brown, in his first report on the subject of Abutilon fibre cultivation, says :—" It must be remembered that success in this new field of enterprise is dependent upon the cost of the product. Unless we can substitute mechanical appliances to offset the cheap labor of India, we cannot hope to attain success in producing jute fibre. But we need not entertain doubts in reference to future mechanical achievements in manipulating either jute or ramie filaments."

It is stated that an acre of ground will produce 5 tons of Abutilon stalks, and about 20 per cent. of pure fibre is obtained after preparation. Considered superior to jute fibre as imported, the long fibre is fully equal in value to Calcutta prime jute, and Philadelphia rope manufacturers have already offered to buy any quantity at the highest market price for jute. Bleached and cottonized for fabrics, Mr. Lefranc pronounces the Abutilon fibre good for weaving tissues and for mixing with a certain class of woollen goods. *Abutilon Avicennæ* in its crude state is worth from 8 to 10 dollars per ton.

Hibiscus heterophyllus, Vent. The Queensland Sorrel Tree. The "Batham" of the aborigines. A tall shrub or small tree, leaves three-lobed or palmate ; flowers, large, white, base of petals crimson or maroon ; they are exceedingly beautiful and delicate in appearance. The plant is chiefly found on the banks of creeks and rivers, but sometimes in open country. The young shoots, leaves, and roots of young plants are eaten by the natives. The fibre is white, strong, and of fine texture, and is prepared by maceration. Habitat, New South Wales and Queensland.

Hibiscus splendens, Fraser. The Hollyhock Tree. A coarse-growing, pubescent shrub or small tree, attaining a height of 10 to 20 feet ; branches covered with numerous short, stout spines ; flowers of a deep pink or rose-colour, very beautiful, borne in great profusion, and not unlike a hollyhock. The fibre obtained from the inner bark is very strong and of fine texture, and is prepared by maceration. Habitat, New South Wales and Queensland, principally on the coast.

Lagunaria Patersoni (Aiton). The Cowitch Tree or Whitewood of Norfolk Island and Queensland. The fibre is prepared by maceration.

Lavatera arborea, L. The Tree Mallow. This tall-growing species, a native of Europe and the Mediterranean regions, has become naturalised around Melbourne. Its bast furnishes a good strong fibre, but of rather coarse texture; prepared by maceration.

Lavatera olbia, L. The Velvet Mallow. This species closely resembles the preceding, and so nearly do their fibres assimilate that it is impossible to tell them apart. The mode of preparation of the fibre is by maceration. Habitat, South Europe.

Lavatera maritima, Willd. The Sea Mallow. A fast-growing perennial. Worthy of cultivation on a large scale for the very beautiful and excellent quality of its fibre. In the Melbourne Botanic Gardens a plant after being cut down sent up shoots 18 inches long in five or six weeks, thus proving that, with careful treatment, two crops might be obtained in a year. Habitat, Spain.

Plagianthus pulchellus, A. Gray (*Sida pulchella*, Bonpland). The Victorian Hemp Bush. A pretty and graceful shrub or small tree, of quick growth, attaining a height of 6 to 12 feet, not unlike a birch in appearance. It is invariably found growing on the banks of rivers and creeks, and is very plentiful on the Yarra Yarra river, near to Melbourne. It is surprising that as a fibre plant of great value, this should be so long overlooked; it is fully equal to the Queensland hemp (*Sida retusa*), which has already become an article of commercial importance in that colony. The *Plagianthus* possesses the advantage of being much longer in staple. The fibre is very soft and glossy, and should form a good warp yarn, either by itself or as admixture with some other material. Habitat, Victoria, New South Wales, and Tasmania.*

TILIACEÆ.

JUTE.—One of the most important vegetable fibres is Jute, obtained from the inner bark of some species of *Corchorus*, especially cultivated in the East Indies. In its nature it is next to our hemp, and is already so much employed that every year about 500 million kilograms are wrought up. Also in Germany the Jute Industry is now very flourishing, owing to the fact that textures of Jute are fabricated in the most elegant types with, as well as without colour, for a number of different articles, as curtains, &c., which have caused Jute to be much in demand. Except in the preparative manipulation, Jute is spun almost like hemp. The preparative manipulation aims especially at making the fibre soft and flexible, since in the natural state it is very rough and rigid. For this purpose bundles are laid upon one another, are sprinkled with water and fat (commonly train oil—20 tons of water and 2½ tons of train oil for 100 tons of Jute), and are allowed to remain, according to the warmth, 24 to 48 hours, or till all the water has been sucked up and the fat has covered the surface. Prepared in this manner the stalks are strongly squeezed between rollers, and heckled in strong heckling machines, whereby the fibres now to be wrought up like hemp, are isolated. — Detailed in *Pfuhl,* "Jute and deren Verarbeitung," Augsburg, 1878.

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* U. S. Government Report.

LEGUMINOSÆ.

Sida rhombifolia.—In speaking of Dr. Roxburgh's specimens, Royle says "the fibres are from 4 to 5 feet in length, and display a fine, soft, and silky fibre, as well adapted for spinning as jute, but infinitely superior."

Sterculia acerifolia is a native of New South Wales, and is a lofty tree. Dr. Guilfoyle states that the bark is fully two inches thick when the tree is full grown, and furnishes bast of a most beautiful lace-like texture. The fibre is very simply prepared by steeping, and is suitable for cordage and nets, ropes, mats, baskets, &c., and is useful as a paper material. The tow is of a very elastic nature, and is suitable for upholstering purposes, such as stuffing mattresses or pillows.

Crotalaria tenuifolia.—Jubbulpore hemp.—This plant, considered by some authors to be a variety of *C. juncea,* is said to be superior to Russian hemp (*Cannabis sativa*), breaking approximately at a strain of 95 pounds for the first named to 80 pounds for the latter. It is 4 or 5 feet in length, and resembles best St. Petersburg hemp, compared with which Royle considers it equal, if not superior. Although its cultivation is limited, it is regularly grown for its fibre, which is used for the same purposes as Sunn.

Ten per cent. is lost in heckling, and the cost and quality varies according to the locality or season of the year in which it is grown. From a report of the Agri-Horticultural Society of India, plants nine weeks from seed "had attained the height of 8½ feet *without branching,* an important point in a fibre-producing plant, and commenced flowering three months from sowing." *C. tenuifolia* is a native of Coromandel, and is a perennial plant. It grows to a height of 9 feet in the Botanic Gardens of Calcutta. It is generally grown upon hill sides, and is far stronger than when cultivated in the plains below, the lower situations tending to produce plants of great height, but of weaker fibre; while soil and climate have much to do with its superiority, it is also due to careful manipulation in its preparation.

Muntingia calabura.—This tree abounds in the West Indies and South America, where its wood is valuable for many purposes, and especially for making staves. In Venezuela it is known as *Majaguillo,* and its fibrous bark is sometimes used for coarse ropes and cordage. Its bast is very soft and pliable, twists easily, and if used in this manner, without attempting to separate or clean the fibres, is possessed of ordinary strength. The fibrils are exceedingly fine and silky, so much so that the bast, when broken, exhibits at the point of rupture the flossy appearance always seen at the raw ends of skein or embroidery silk. Separating the fibre would undoubtedly diminish its strength, but it would probably felt well for paper-making.*

ASCLEPIADACEÆ.

The *Asclepias syriaca,* a native of America, produces a silk-like down, which is used for stuffing pillows, while other species of the same genus furnish an excellent fibre, which is woven into muslins, and in certain parts of India is made into paper.

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* U. S. Government Report.

Marsdenia tenacissima.—Rajmahl Bowstring Creeper.—This plant produces the *jeetee* fibre of India. The plant grows in the Rajmahl hills of India in dry and barren places, and the fibres of the bark are employed for making bowstrings by the mountaineers. "The fibres are not only beautiful in appearance, but strong and durable."

In Dr. Roxburgh's tests of twine made from *jeetee*, he found that in the dry and wet states it bore a strain of 248 and 343 pounds, when hemp in the same states bore 158 and 190 pounds. More recent tests, however, place it below hemp in strength, but above it in elasticity. The fibre is much used for making nets, and is not liable to injury by being kept in water.*

THYMELACEÆ.

Dais cotinifolia (Linnæus). The African Button Flower. A magnificent glaucous foliaged tree, bearing a profusion of pink globular heads of Pimelea-like flowers of exceeding beauty. The bark is very tough, a characteristic feature of Thymeleads. A valuable yellow dye has been extracted from the bark at the Melbourne Botanic Gardens. Habitat, Cape of Good Hope.*

URTICACEÆ.

Bœhmeria nivea.—Ramie, China Grass.—This is another plant of practical value to American agriculture, though its importance can hardly be said to be appreciated, save by the few who have fought over the ground of experiment. In India it is commonly known as *Rhea*, having been cultivated from time immemorial in Assam, Dinglepore, and Sylhet, where it is regarded as most useful for fishing nets. The cultivated variety, though botanically the same as the wild, is called *Dome rhea*, and is used for making nets and fishing tackle, while the latter variety is called *Ban rhea*. With the Singpoos the name is *Pan*, and cloth is made from it, while in Burmah it is used to make a kind of linen. In Sumatra it is called *Calœe*, and the Chinese name is *Chu ma*. Several varieties of Boehmeria are cultivated in Japan, and the process of preparing the fibre is similar to that in use for the preparation of hemp, and indeed, all of their best fibres. The China Grass industry in Japan dates back to 1660 A.D., and the finest fabrics are manufactured at Yechigo (to the north of Tokio, on the west coast). The annual production amounts to nearly 100,000 pieces of goods, 9 to 10 yards in length.

The strength of this fibre, judging from Dr. Roxburgh's experiments, places it in the first rank. He found that *Jeetee* fibre (*Marsdenia tenacissima*) broke with a strain of 248 pounds, when *Calœe* (or ramie) broke with 240 pounds. Chinese jute was broken at 164 pounds, while hemp (*Cannabis sativa*) only stood a strain of 158 pounds. A recent experiment quoted in an Indian report shows a still greater difference between this and other fibres, a spun thread of Russian hemp having broken with a strain of 84 pounds, while a similar one of ramie only broke with the remarkable strain of 252 pounds, or in the proportion exactly of one to three.

Pipturus argenteus, Wedd. (*P. propinquus*, Wedd). The Queensland Grass-cloth Plant or Native Mulberry, called by the natives "Kongangu." A tall shrub, sometimes assuming the character of a tree and attaining a height of 50 or 60 feet, the foliage being very similar to that of the Bœhmerias. It is met with chiefly on the banks of creeks and rivulets. The white berries are eaten by the natives. The inner bark affords a fibre of fine texture and of great strength ; it is, however, rather difficult of preparation. A rich brown dye is also obtained from the bark. It is found in Queensland, North Australia, India, America, and Islands of the South Pacific.

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* U. S. Government Report.

Urtica gigas. — Tree Nettle of Australia. — This is also called the gigantic nettle tree, and by the natives, *goo-mao-mah.* It is a native of New South Wales, and is very abundant on the McLeay and other northern rivers. In Bennett's " Wanderings of a Naturalist in Australia," the author states that the tree, when in full vigor, rises from its base by a series of buttresses of singularly regular outline, gradually tapering without a branch, to the height of 120 to 140 feet; the trunk then divides into a regularly formed, wide-spreading head, which excites admiration by its extraordinary size. The ordinary elevation of the tree is 25 to 50 feet. " The poisonous fluid secreted from the foliage is very powerful, particularly in the younger leaves, and their sting is exceedingly virulent, producing great suffering." The tree is also indigenous in Queensland, and Dr. Guilfoyle sends specimens of fibre from Victoria. The fibre is very strong and fine, and suitable for fishing-lines, &c. In New South Wales its fibre is made into cordage of considerable tenacity. The wood of this tree is soft and fibrous, and might be pulped up for fibre. It is claimed that the best and strongest fibre is obtained from the bark of the roots. The fibre is easily prepared and can be obtained in quantity.*

Urtica heterophylla.—The Horoo Surat of Assam.—A specimen of this cleaned fibre has been brought to London by Mr. LIDDELL, and it was valued at £125 per ton. The stems untreated were also examined, but no system was then known of operating on them successfully.

Mr. EKMAN says that they will easily succumb to his process.

A good supply of stems have arrived from India, so trial will be made here.

Dr. ROYLE speaks of the Neilgherry Nettle as follows:—

"Neilgherry Nettles, produced by *Urtica heterophylla*, were sent by Dr. Wight to the Exhibition of 1851. The plant is found in Burmah and in Assam, and along the foot of the hills extending to the Deyra Doon. It may be seen even in the northern valleys of the Himalayas. It is an annual, with erect angular stems, marked with small white specks, in which are inserted stiff, most acute bristles. The leaves are long, petioled, caudate at the base, variously lobed, and towards the top of the plant almost palmate; all are grossly serrate, armed with the same bristles as the stem and branches, from four to eight inches long and nearly as broad. The bark abounds in fine, white, glossy, silk-like, strong fibre. Major Hannay says of it, that it is the *Horoo Surat* of the Assamese, and known to the Bhotecas as the *Serpah* or *Herpah*—that the fibre is extensively used by them in the manufacture of cloth. It was recognised by the Chinese as the *Theng Mah*, and said to be prized for the softness of its fibre, as well as for its strength. As the seeds are quick of vegetation, the cultivation of this plant can be carried to any extent.

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* U. S. Government Report.

The fibre of this Nettle, sent from the Neilgherries, is very long, soft, white, and silky, and has been much admired by many of the best judges of fibres. The specimens were sent by Dr. Wight, and prepared in a rude way by boiling by the Todawars of the Neilgherry Mountains. Dr. Wight says of it, that 'it produces a beautifully fine and soft 'flax-like fibre, which the Todawars use as a thread material, and if 'well prepared fitted to compete with flax for the manufacture of even 'very fine textile fabrics.'"*

The great point to be settled is, what the length of the normal fibre is, and how it will spin.

Broussonetia papyrifera.—The Paper Mulberry.—This interesting and well-known plant is a native of the islands of the Southern Ocean, as well as of China and Japan, but has been introduced into many other countries, and is now a common tree in gardens. In Japan, where it is highly esteemed for its fibrous qualities, it is known as the *Kodzu*; in China it is called *Tchou* and *Hoa-ko-chu*. *Kendang* is the Javanese name for the plant, while in the Fiji Islands it is known as *Ma-lo.*

In Tahiti and other South Pacific islands a species of cloth is manufactured from its bark known as *Tappa*, *Tapa*, or *Kopa.*

It is said that the finest and whitest cloth and mantles worn by Sandwich Islanders and "the principal people of Otaheite," are made from the bark of this tree. It dyes readily, particularly in red, and takes a good color. Tapa cloth is also printed; a large sheet from the Fiji Islands, in possession of the department, being stamped or rudely printed in black, in large checks or squares resembling the patch-work comfortable. The manner in which the fibre is beaten out by the native women of Otaheite is very curious. The cleansed fibres are spread out on plantain leaves to the length of about 11 or 12 yards; these are placed on a regular and even surface of about a foot in breadth. Two or three layers are thus placed one upon another, much attention being paid to making the cloth of uniform thickness; if thinner in one place than another a thicker piece is laid over this place, when the next layer is laid down. The cloth is left to dry during the night, and, a part of the moisture being evaporated, the several layers are found to adhere together so that the whole mass may be lifted from the ground in one piece. It is then laid on a long smooth plank of wood, prepared for the purpose, and beaten with a wooden instrument about a foot long and three inches square. Each of the four sides has longitudinal grooves of different degrees of fineness, the depth and width of those on one side being sufficient to receive a small pack-thread, the other sides being finer in a regular gradation, so that the grooves of the last would scarcely admit anything coarser than sewing-silk. A long handle is attached, and the cloth is first beaten on its coarsest side, and spreads very fast under the strokes; it is afterwards beaten on the other side, and is then considered fit for use. Sometimes, however, it is made still thinner by beating it, after it has been several times doubled, with the finest side of the mallet, and it can thus be attenuated until it becomes as fine as muslin. Should the cloth break under this process, it is easily repaired by laying on a piece of bark, which is made to adhere by means of a glutinous substance made from arrowroot, and this is done with such nicety that the break can hardly be detected. In other islands the bark is kept wet and scraped with sharp-edged shells. It is said the King of the Friendly Islands had a piece made which was 120 feet wide and 2 miles long.

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* Dr. Royle's "Fibrous Plants of India."

In Japan, it may be mentioned as a peculiarity that a kind of cloth is made from paper derived from this tree. It is cut into thin strips, which are twisted together and spooled, to be used in the woof of the fabric, while the warp is composed of silk or hemp. About 250 pieces only are manufactured at the principal manufacturing place. The paper-mulberry grows everywhere in Japan, and is a valuable tree, as furnishing the bast from which a large portion of the Japanese paper is made. The plants are reproduced in quantity by subdividing the roots, and in two or three years are ready to be cut. This work is done in November, and the branches (7 to 10 feet long) are made up into bundles 3 or 4 feet in length, and steamed, so that the bark is loosened and can be more readily stripped off. This is washed, dried, and then again soaked in water and scraped with a knife to remove the outer skin, which is used for inferior kinds of paper. The bast when cleaned is washed, repeatedly kneaded in clean water, and rinsed. It is then bleached in the sun until sufficiently white, after which it is boiled in a lye, chiefly of buckwheat ashes, to remove all gummy matters. The fibres are now readily separated, and are transformed into pulp by beating with wooden mallets. The pulp is mixed in vats with the necessary quantity of water, to which is added a milky substance prepared from rice-flour, and a gummy infusion of the bark of *Hydrangea paniculata*, or of the root of *Hibiscus Manihot*. The couches on which the paper sheets are produced are made of bamboo, split into very thin sticks, and united in parallel lines by silk or hemp threads, so as to form a kind of mat. This is laid upon a wooden frame and the apparatus dipped into the vat, raised, and shaken so as to spread the pulp evenly, after which the cover is first removed, then the bamboo couch with the sheet of paper, and in returning the operative lays the sheet upon the others. When a number of sheets have thus been prepared they are pressed to exclude the water, and afterwards spread out with a brush upon boards and allowed to dry. The sheets are only about 2 feet in length, but sometimes sheets 10 feet long are produced.

Vétillart says that the fibres of this plant, when separated (by boiling in an alkaline solution and afterwards ground in a mortar), "appéar perfectly transparent, are striated longitudinally, and are often flattened on each other, and convoluted like a ribbon; the points are fringed and terminate in a round end. They have a tendency to crisp and curl up into rings, which indicates that they can be readily felted." As to size, those bordering on the epidermis are larger than the fibres in the parenchyma which border on the zone of the *cambium*.*

BROMELIACEÆ.

Ananassa sativa.—Pine Apple.—This plant is supposed to be a native of Brazil, and to have been introduced into the East and West Indies; it is now found in many parts of the Old World, where it has become so established and apparently wild as to be thought indigenous. It flourishes in Assam, in India, and on the west coast of Africa. In the Philippine Islands it grows in great abundance, and is valued on account of its fine hair-like fibres, from which is woven the celebrated pine-apple cloth of the Philippines. M. Perrouttel, however, considers this a distinct species, and has named it *Bromelia pigna*.

In the Rungpore district of India the fibre is much used by the local shoemakers for twine, though it is cultivated principally for its fruit-bearing qualities, its fibre being but little appreciated.

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* U.S. Government Report.

When preparing the fibre of the pine-apple, the leaves must be manipulated in the green state, as nothing can be done with them when dry. The leaves are laid upon a board, and the epidermis removed with a broad knife. Upon its removal from the upper surface, the fibres are seen lying upon the lower and denser epidermis, running in a longitudinal direction. Although very fine, the process of bleaching, by destroying the adhesion between the bundles of fibres, renders it so much finer that it can be spun like flax. In the East Indies, where the pine-apple was introduced as early as 1600, the fibre is extensively used in the manufacture of the delicate fabric called piña, as well as for cordage. Piña is considered to be more delicate in texture than any other known vegetable fibre. It is woven from the untwisted fibres of the Ananassa leaf, after they have been reduced to extreme fineness, and after the ends have been glued together to form a continuous thread.

It is claimed for pine-apple fibre that constant immersion in water does not in the least injure it, and the natives of the East Indies increase this property by tanning it, though it is probably at the expense of strength.

The filaments of pine-apple are very fine and flexible and very resistant. They are easily divided after treatment in the alkaline bath, and after being submitted to trituration. The isolated fibres are very fine, of a tolerably regular diameter from one end to the other, but of very different size. The interior canal, which is very perceptible in the largest, is not so in the smaller ones. They are very flexible, curling and crisping readily under mechanism. The points are rarely sharp, and taper gradually to the extremities. They are rounded, or rather blunt, at the end.

In tests of strength, pine-apple fibre exhibits superior tenacity. The fibre from Singapore bore a strain of 350 pounds against 260 pounds for New Zealand flax. This last named has been proved equal, and in some experiments superior, to best English hemp. In the Journal of the Agricultural Society of India, vol. iii, p. 182, there is a record of a rope of pine-apple fibre, 3¼ inches in circumference, standing a strain of 5,700 pounds before breaking (refer to experiment with plantain fibre, when same-sized rope was used, under head of *Musa paradisiaca*). Pine-apple fibre is much valued in Brazil.

Bromelia sylvestris.—Wild Pine-Apple.—This is also known as the "silk grass," of British Honduras. It is the *Istle* and *Ixtle* of Mexico, and the *Pita* (incorrectly called) or *Piñuella* of Central America. The plant in Mexico is called "*lechugilla.*" This plant also belongs to the pine-apple family, and is widely diffused throughout the tropics, growing everywhere and in all varieties of soil. It is common on the rocky hills of the West Indies, and particularly in Jamaica, where the plants are used as hedges and fences. Its leaves are steeped in water by the natives, and, after beating with a wooden mallet, yield a strong fibre. It is in common use for cordage on the island of St. Domingo, and is favorably mentioned by Dr. Parry in his report. The leaves from which the fibre is obtained are from 1½ to 3 inches in width and 5 to 8 feet long. They are quite thin and are lined with a fine, tough fibre, which some authorities consider a superior substitute for flax. In portions of Mexico the Bromelia is cultivated for its fibre, which is described as very fine, from 6 to 8 feet in length, and from its fineness and toughness commonly used in belt-making works. It also finds application in the manufacture of many articles, such as bagging for baling cotton, wagon sheets, carpets, &c., besides forming a valuable material for making cordage, nets, hammocks, and similar articles of common use. In Mexico the leaves were formerly subjected to the slow and laborious process of hand-scraping, and, as large quantities of the fibre were used annually, suitable machinery was very much needed. In 1875 this want was supplied by native invention, so that now "Istle" fibre is produced in any quantity and in an economical manner. As early as 1830, there reached the port of Vera Cruz, by the pass of the San Juan alone, over 188,000 pounds of dressed fibre. On the Isthmus of Tehuantepec it is used by the natives in the fabrication of thread, cordage, mats, bagging, clothing, and for hammocks, and the fibre is sometimes made into paper. It is also manufactured into cloth by the Spaniards, for hammocks.

The fibre of the young plants is fine and white, though necessarily short. It has been found that the more mature the plant, the coarser and longer the fibre, so it is an easy matter to select just the quality of fibre desired. The plants are armed with spines or thorns—used by the natives for needles and pins—though these disappear in cultivation.

Specimens of Bromelia fibre, from British Honduras, were brought to the notice of the Royal Society of Arts in 1857, and from examinations then made "it was ascertained that each fibre contained from five to twelve or more filaments, held together by gummy matter capable of being dissolved by proper processes. Specimens had been passed over the comb or heckle of a flax-mill, and had been pronounced by the most experienced flax spinners (of England) to be greatly superior to Russian flax, and approaching the best description of Belgian in capability of application to the finest textile fabrics."

Squier states that the fibre of this plant is probably more valuable in every sense than that of any other tropical plant, and would seem to be produced more readily than that of *Agave Sisalana.*

Microscopically the fibres of *Bromelia* differ from those of *Ananassa sativa.* The interior canal is much more apparent and the walls thinner. The fibres often present great inequalities in the diameter of the same specimen as well as in the thickness of the walls.*

LILIACEÆ.

The treatment of aloe fibre is one that hundreds of people have tried to master upon commercial principles. An American machine has been tried that removes the pulp, and I think will work with the Ekman process.

I also record a discovery which promises important results, that has lately been made by a scientific gentleman in the island of Réunion, situated near the Mauritius. He claims to have succeeded in solving the problem of extracting vegetable fibre from the aloe or other leaves in an economical manner, and one which can be generally adopted. The principal features of the invention are as follows:—The leaf is first placed for ten minutes in a bath heated to 95° Fahr., and then removed to a second bath of water at the normal temperature, in which some inexpensive chemical substance (not yet made public) has previously been mixed. The leaves are allowed to remain some little time in the second bath, after which it is said that the fibre can be washed out by women or children without any trouble. A patent has been taken out for this process by its inventor.

As the aloe is known to grow as freely as weeds in this colony, this discovery would appear to present the means of establishing a new and profitable industry for a very large proportion of our population.—*The Tropical Agriculturist,* Vol. I, No. 2, p. 132.

Dasylirion glaucophyllum. The glaucous-leaved Dasylirion. This beautiful plant has been tried out of doors for the last two years and with the greatest success, having withstood the winter of Melbourne very well. It is readily increased by off-sets. The leaves afford a fibre of good quality. Habitat, Mexico.

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* U.S. Government Report.

Dianella elegans, Kunth. The elegant Flax Lily. A beautiful blue-flowered perennial plant, very plentiful along the coast of Victoria and Tasmania. Fibre strong, and of silky texture.

Dianella longifolia. The long-leaved Flax Lily. A very pretty perennial plant, producing a profusion of blue and yellow flowers on a tall smooth stalk, which are succeeded by beautiful dark blue globular berries, which render the plant quite as attractive in a fruiting state as when in flower. Its leaves attain a length of 18 inches to 2 feet, and furnish a fibre of fine silky texture. The aborigines formerly used this plant amongst others for the purpose of making baskets, etc. Habitat, Victoria.

Doryanthes excelsa (Correa de Serra). The New South Wales Spear Lily. A robust plant somewhat like and often mistaken for the Giant Lily or Sisal Hemp Plant of South America (*Fourcroya gigantea*). The leaves of the latter, however, when bruised, emit a most fœtid odour, a quality entirely absent in the Doryanthes. The deep crimson flowers arranged in a corymbose head on a tall scape have a very fine and singular effect. The leaves are a mass of fibre, of great strength, which admits of preparation, either by boiling or maceration, no perceptible difference as to quality or colour being apparent after heckling. Suitable for brush-making, matting, &c. Habitat, New South Wales and Queensland.

Doryanthes Palmeri (Hill). The Queensland Palm Lily. This very beautiful species is very closely allied to the foregoing *D. excelsa*, the chief difference being in the form of the inflorescence, which in *D. excelsa* is a globular head or corymb. In *D. Palmeri* the flowers are arranged in a spicate or thyrsoid manner. The fibre assimilates very closely to that of D. excelsa. Prepared by maceration. Habitat, Queensland.

Dracæna Draco (Linnæus). The Dragon Tree. This very beautiful and remarkable plant thrives well out of doors in the vicinity of Melbourne. The fibre from the leaves is very strong and of good quality, and is prepared by boiling. Habitat, West Africa, Canary Islands.

Fourcroya gigantea, Vent. The Fibre or Giant Lily. A native of South America, this magnificent plant succeeds remarkably well in Victoria near the coast. Its leaves furnish the Sisal Hemp of commerce. The fibre is prepared by maceration. Habitat, South America.

Phormium tenax.—New Zealand flax.—Its fibre is almost white in color, flexible, soft, and of a silky lustre. The bundles of fibres are formed of filaments of unequal size, which are easily separated by friction. It has considerable elasticity, but readily *cuts* with the nail. Microscopically examined, according to Vetillart, the fibres are remarkable for their slight adherence. The individual fibres seem very regular, having a uniform thickness, and the surface is smooth ; they are stiff, straight, and very fine, and the central cavity is very apparent.

As to tenacity, Royle gives the breaking point of New Zealand flax, compared with flax and hemp, as 23.7 to 11.75 and 16.75, respectively. In the official hand-book of New Zealand it is stated that " during a late severe gale at Auckland it was found that flax rope, when subjected to the same strain as Manila hemp (*Musa textilis*), remained unbroken, while the other gave way."

Sanseviera zeylanica, Sanseviera guinænsis, Sanseviera latifolia.—The name Bow-string Hemp, generally given to the first-named species, has also been applied to other plants of the genus, *S. guinænsis* being called African Bow-string Hemp. *S. zeylanica* is the best known, however, and is common on the Ceylon coast, from which it takes its name. The plant has been known and prized in India from remote antiquity under the name of *Murva.* In the Catalogue of Indian fibres (Exhibition, 1862), it is called *Moorga, Mazool,* and *Moorgavee*—also spelt *Moorgahvee.* It is at present known under the vernacular name of *Murgavi, Murga,* and *Mazool.* Its sanscrit synonym is *Goni.* The plants of the genus *Sansevıera* abound on the coast of Guinea, around Ceylon, and along the Bay of Bengal, extending to Java and the coasts of China. They are stemless, perennial plants, throwing out runners, and having only root leaves, which are thick and fleshy, and usually sword or lance-shaped, with sheathing bases. They flower from January to May, and the plants grow wild in the jungles. They are easily propagated on almost every soil, from the slips which issue in great abundance from the roots, needing little or no care, and not requiring to be renewed often, if at all.

Dr. Buchanan found this plant employed in the manufacture of cordage at Bangalore, and bow-strings are still made of it in the Sircars, and along the coast of Bengal. In the interior of Bengal it is equally common and wild, but not so largely used for fibre. The leaves are 3 or 4 feet long when the plant is cultivated, and the fibre, which extends the whole length, is separated from the pulpy portion. The native method of preparing the fibre is to place these leaves "upon a smooth board, pressing one end of the leaf down with one of the great toes, and with a thin bit of hard stick, held between the two hands, scraping the leaf from them, every part of the pulp is quickly removed." This is also accomplished by steeping the leaves in water until the pulpy portion decays, when the fibre is washed and cleaned, though in some cases steeping dissolves the fibre. It is estimated that 40 pounds of fresh leaves 3½ or 4 feet in length will yield a pound of clean fibre, or over 1,600 pounds of cleaned fibre per acre, at a gathering; with a favorable season two such gatherings may be assured annually.

Royle states that the untwisted fibre will bear a strain of 280 pounds compared with Agave, which bore 270 pounds, though Dr. Wight's experiments gave 362 pounds for Agave to 316 pounds for the *Sanseviera.* Dr. Roxburgh ascertained that a line of Moorga fibre 4 feet long bore a weight of 120 pounds, when a cord of the same size, made of Russia hemp, bore but 105 pounds. After remaining in water 116 days, the former bore a weight of 30 pounds, while the latter was entirely rotten. It is not considered equal to Manila hemp.

Fibre of *S. guinænsis,* which is sometimes introduced into the markets of Europe, has been thought by some to be superior to New Zealand flax. The strength of its fibre, as tested by the Agri-Horticultural Society of India, was found sufficient for hawsers and cables, while their fineness and tenacity are attested by their being used by jewellers for thread upon which to string pearls.

Tritoma uvaria, Ker. The Queen's Torch Lily. This plant furnishes a valuable fibre of considerable strength. It is of a light chocolate colour, and is prepared by boiling. Habitat, Cape of Good Hope.

Tritoma recurvata. The Recurved Torch Lily. This very robust-growing species furnishes a splendid fibre, and so readily is it prepared by a boiling process that leaves growing in full vigour at 10 a.m. have been manipulated and passed through the heckling machine by 4 p.m. The properties of these plants (*Tritoma*) were first brought under notice, as regards their fibre-yielding qualities, by the Director of the Melbourne Botanical Gardens in 1876. The genus is very easily propagated by offsets or root division, and succeeds well in moist or swampy localities.

Yucca gloriosa, also called *Petre* by the Mexican Spaniards, according to Nuttall, "is used for cordage, ropes, &c., as well as for packing cloth, and is extremely durable." Elliott, in his Botany of South Carolina, speaks of it as one of the strongest fibres of the vegetable kingdom.

The filaments of Yucca are white, brilliant, and stiff, composed of irregular bundles, the most of which are large. By rubbing briskly between the fingers the bundles break up into finer fibres, but always preserve a great deal of stiffness. The walls are usually thick, and the central cavity very apparent; the ends grow slender regularly, and are rounded at the extremity.

JUNCACEÆ.

Juncus vaginatus, R. Br. The Sheathed Rush. Two forms of this plant occur in Victoria, where it is very common. One variety does not exceed 2 feet, whilst the other very often attains a height of 5 feet. It is an excellent paper plant, and yields by boiling a fine strong fibre. Habitat, Victoria, &c.

IRIDACEÆ.

Moræa (*Iris*) *Robinsoniana*, F. Muell. The Wedding Flower of Lord Howes Island. A noble plant of great rapidity of growth, leaves 5 feet long and 3 inches broad; it yields a fine fibre by maceration or by a boiling process. Habitat, New South Wales.

AMARYLLIDACEÆ.

Agave Americana.—Century Plant.—In America the plant is known as the American aloe, *Carata* and *Pita*; the last name is also given to the fibre. It is known in India as *Cantala* and *Bans-Keora*.

This plant, which is now found growing in many parts of the world, is well represented in the Government collections. It gives a brilliant fibre of considerable strength, which is useful for many purposes. The Indians of Mexico and Arizona use it for saddle-cloths and cordage. The "saddle-cloths" are not woven, but are merely masses of fibre of regular thickness, tacked with thread at regular distances, in the same manner that mattresses are secured and the hair kept in place. In the West Indies it is employed by the negroes for making cordage, hammocks, and fishing lines, and in Mexico is utilized in the manufacture of ropes for use in the mines, and in some cases for the rigging of ships. In South America it has even been used for large cables. Humboldt mentions a bridge in Quito with a span of 130 feet constructed of ropes of Agave fibre, some of them 4 inches in diameter.

The name *Pita* follows it to Spain and Sicily, where it is used for cordage and mats. In New South Wales "it produces such an excellent fibre, of such strong and durable quality," that it is recommended for cultivation for its fibre alone, particularly as "it will grow in almost any situation, and so freely that under favorable circumstances it will flower in from seven to eight years."

The plant is so well known from the examples to be met with in our conservatories that a description seems hardly necessary; however, the leaves are from 3 to 6 feet in length, are thick and fleshy, and formed of hard, pulpy matter intermixed with the fibres; they are armed with sharp spines. both at the point of the leaf and along the margins.

When the fibre is extracted by hand, the leaves are crushed and macerated in water, and the fibres separated from the parenchyma by beating. Fibre is contained in the roots as well as leaves. Another plan in vogue is to lay the long leaves upon a board, and then to scrape them with a square iron bar held in both hands until all the juice and pulp are pressed out, leaving the fibre ready to be cleaned.

Dr. Forbes Royle states that the Indian *Pita* has been found superior in strength to either coir, jute, or sunn hemp. In a trial of strength near Calcutta, the tests were made with ropes one fathom long and three inches in circumference, with the following results:—The agave or pita broke in a strain of 2,519¼ pounds; coir, 2,175 pounds; jute, 2456½ pounds, and sunn hemp 2,269½ pounds. In an experiment with Russian hemp and pita, the first named broke with 160 pounds' weight, and the latter with 270 pounds. These experiments shew the great strength of the fibre, which is worthy of more extended cultivation and employment in the arts.

Agave fibre is composed of large filaments, white, brilliant, stiff, and light (in weight). They are easily separated by friction, while at the same time preserving their stiffness.

HENEQUEN FIBRE, OR SISAL HEMP.—This fibre, which is increasing in importance every year, and which is usually attributed to *Agave Sisalana*, is obtained from several species and varieties of "Agave" and "Fourcroya" plants in Yucatan and Mexico. Five varieties of *Agave angustifolia*, Haw., are cultivated, and two of *Fouroya Cubensis*, Willd., although the plants grow wild throughout the whole of those countries. From 625 square yards of land with 64 plants 1600 leaves are obtained every year, which furnish 64 pounds of merchandise ready for sale. After 12 to 15 years the plant dies, but sends out collateral shoots. To prepare the fibre the leaf is laid upon a stick and scraped with a wooden fork till all the pulp of the leaf is stripped off. The remaining rude fibre is bleached and dried in the sun. The Government of Yucatan has instituted a commission for information on Henequen fibre.

According to the report of the commission the fibre is used principally for making cables and ropes of every kind, from the finest to the strongest. Bags for maize, rice, coffee, cocoa, sugar, beans, &c., are also fabricated from Henequen, also common textures for stuffing ware chests, &c. The principal reason why Henequen is preferred to other fibres is its cheapness and its small specific weight. On this account the fibre, also at the same price for the unit of weight, must always be cheaper, because from the same weight a cable of larger dimensions can be made than from other fibres. Besides this, the Henequen cable in a cold climate remains more flexible than one prepared from Manila hemp or common hemp, and therefore it is principally used for cordage on North American ships. The fibre is more easily dyed than any other of the same class, so that it is most useful for making fancy articles of different kinds. The export of Henequen in 1870 was only 18,000 packages, but amounted in 1874 to 26,000, and in 1878 to 54,000 packages. This amount was expected to increase in 1879 to 70,000 packages. Almost the whole quantity of the roughly exported Henequen, and of that wrought up into hammocks, was brought to New York or to other harbours of the United States. For several years small quantities have been brought to European harbours. The Henequen fibre, wrought up to cords and sacks, &c., is also brought to Habana and to some harbours of Mexico.

Agave Sisalana.—Mexican Grass, Sisal Hemp.—Also called grass hemp. It is the *Cabulla* of Central America, and the *Losquil Henequen* or *Jenequen* of Yucatan, and produces the fibre known as Sisal hemp.

In Yucatan the two varieties of the fibre are distinguished as the *Yashqui henequen*, which produces the best quality, and the *Sacqui henequen*, which gives the greatest quantity. It is worked by machinery, and from July, 1875, to June, 1876, Yucatan produced 22,000,000 pounds of Henequen fibre, 18,000,000 pounds of which were sent to British ports. The remainder was sent to Cuba and Mexico. I am unable to give the figures as to the American importation in late years, but the amount must be considerable, as the fibre is now in high favor as a cordage material, manufacturers claiming that it has been growing better and better each year in quality. A few figures are given in the latter part of the flax and hemp report, under the heading " Other Fibres," which will give some idea of the amount consumed at present in this country. A recent report, published in Yucatan, gives the following figures :—Taking $1\frac{1}{4}$ pounds of fibre for the yearly production of each Henequen plant, we come to the conclusion that at present there are more than 18,000,000 of plants under cultivation. For this number of plants over 420 scraping wheels are in operation, moved by 229 steam engines, with a force of 1,732 horse-power, and 30 wheels moved by animal power. Each scraping wheel cleans daily, on an average, 300 pounds of fibre; so the 450 wheels in existence do not work at present 163 days in the year.

It is estimated that in Yucatan alone a capital of over 5,000,000 dollars is invested in this industry.

A peculiarity of this fibre is, that it resists the action of dampness for a greater length of time than hemp of similar fibres, which makes it very desirable in the manufacture of cable-ropes, &c., used in the rigging of ships.

GRAMINACEÆ.

BAMBOO (*Bambusa*).—This gigantic graminaceous plant is remarkable for its rapid growth, one plant of *Bambusa gigantea* having been found to grow to a height of 60 feet in twelve weeks, in the hot-houses of the Duke of Northumberland; and a *Bambusa vulgaris*, in the houses of the Duke of Devonshire, to forty feet in forty days.

The Bamboo will flourish well wherever there is moisture and heat, but if the young shoots are taken off, the plant dies, and whole Estates are ruined.

The fibre of young bamboo stems forms a valuable material for the manufacture of paper, according to Mr. Routledge, who advises that the bamboo should be gathered before the plant arrives at maturity, and also before the stem hardens, and throws off the siliceous matter. The green or fresh stem, which contains 75 per cent. of moisture, is passed through rollers and lye wash. Ten barrels of the green fibre produce six of dry fibre similar to tow, an enormous result as compared with that obtained from other fibrous plants. Up to the present time I have been unable to find any paper made from bamboo, and Mr. Vétillart informed me he had tested papers said to be made from bamboo, but they always contained foreign substances.

Poa Australis R. Br., var. *tenax*. The tough Meadow Grass. A tall wiry grass, growing in large tufts or tussocks, and met with principally on the banks of creeks and in swampy ground. The fibre is strong and somewhat like that of the *Dianellas*. The different varieties of *Poa Australis*, which are very numerous, afford excellent paper material. As pasture grasses they are valuable for affording green fodder when most other grasses are burnt up from the excessive heat of summer. They do not, however, contain a great amount of nutriment. Habitat, Victoria, &c.

CYPERACEÆ.

Lepidosperma elatius, Labill. The Tall Sword Rush. Very plentiful on banks of creeks, &c., especially in mountainous districts. An excellent paper plant. The fibre is prepared by boiling. Habitat, Victoria and Tasmania.

Lepidosperma gladiatum, Labill. The Coast Sword Rush. This very plentiful coast plant has gained such a reputation as a paper-yielding material that it is needless to more fully describe it here. Habitat, Victoria, New South Wales, &c.

TYPHACEÆ.

Typha angustifolia (Linnæus). The Native Cat's-tail or Bulrush. This plant is very plentiful throughout the colony of Victoria on the margins of ponds, rivers, &c. It yields a valuable paper material, the fibre is of fine texture and tolerably strong, and with the aid of proper machinery might be converted into textile fabrics. Habitat, Australia, Europe, Asia.

MUSACEÆ.

Musa paradisiaca, the edible Plantain, and *Musa sapientum*, the Banana, like the Manila plantain, abound in fibre, coarse and strong in the outer, and fine and silky in the inner layers, and much of it is well adapted for cordage. Royle, regarding the first-named species, says there is no doubt that the large cultivated plantain of India contains a considerable quantity of strong fibre, in the same way "that the yellow plantain does in Jamaica," and it seems worthy of enquiry whether the wild and useless plantain growing at the foot of the Himalayas "may not *yield a stronger fibre than any of the cultivated kinds*." If the plantain is considered such a superior fibre-producing plant in the Old World, why should it not be equally as valuable in tropical America? It is grown in the West Indies, or, rather, fibre in quantity is prepared from it.

The extraction of plantain fibre is accomplished in two ways, the first by machine-crushing, and the second by fermentation. The tree is cut by a single stroke of a hatchet or cutlass, six inches above the surface of the ground; the trunk is then divided longitudinally into four parts and the heart taken out, which is always left for manure. One man can cut and split 800 trees in a day. If fermentation is decided upon, the trees are left upon the ground until the juice and sap are separated from the fibre, when considerable weight will have been lost, and the labor of transportation much reduced. On the other hand, if the tree is not subjected to this process, it must be carried to the mill at once, and passed through the rollers, which are a foot in diameter, and about three feet long. In crushing, the tender layers are separated from those which are harder and riper, and the different kinds passed through the mill lengthwise, the rollers being placed horizontally. The produce is about 4 pounds of fibre to each tree. "The stalks of the branches give the best fibre, and a larger quantity, as compared with the body of the tree." One hundred pounds of stalk will give about 15 pounds of fibre, net weight, and when a whole tree furnishes 4 pounds of fibre, one-fourth of the quantity is derived from the stalks. One hundred plantain trees can be crushed in twenty minutes, with one horse, allowing five minutes for rest.

After crushing, the fibre is boiled, to separate the gluten and coloring matter, carbonate of soda and quicklime being used as chemical agents.

To make three tons of fibre a day, it is necessary to have four boilers of 800 gallons each, and give five boilings in a day, which amounts to 1,650 pounds of net fibre for each boiler, or 6,600 pounds for the four boilers. They require about 300 pounds of soda, and a proportionate amount of quicklime. As the different grades of fibre are pressed separately, they should also be kept separate in the process of boiling, the lighter fibres requiring about six hours to bleach, while the darkest require fully eighteen. Levers are arranged to lift the mass from the kettles or tanks when sufficiently boiled, allowing it to drain into the boiler before it is carried away to be washed. The washing should be thorough, that no extraneous matter may be left upon the fibre, and the work is done by machinery, such as is used by paper-makers, or the arrowroot-makers in the West Indies. After a thorough washing it is hung up to dry, and when thoroughly dried is ready for baling, hydraulic pressure being used for the purpose. It is estimated that a capital of 25,000 dollars is required for carrying on the cultivation of the plantain on an extensive scale, and 18 tons of fibre can be produced on 5½ acres, at a cost of 870 dollars, or a little more than 48 dollars a ton.

The plantain may be considered a valuable plant for paper-making, and its fibre might possibly be extracted for this purpose alone at a considerable profit—it has been suggested at half the above figures. Dr. Royle suggested utilizing the plant for this purpose twenty years ago, in India, where the tree abounds, but the suggestion had not been acted upon four years ago, as is shown in an official report recently published in Calcutta, where the plant is mentioned, with many others, as one whose fibre should be utilized for paper manufacture.

As to its strength, experiments by Dr. Royle gave most satisfactory results. Fibre from Madras bore a weight of 190 pounds, while a specimen from Singapore stood a strain of 360 pounds, and Russian hemp bore 190 pounds. "A 12-thread rope of (India) plantain fibre broke with 864 pounds, when a similar rope of pineapple broke with 924 pounds." Compared with

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English hemp and Manila (see experiments in tenacity under head of *Musa textilis*), a rope 3¼ inches in circumference and 2 fathoms long, made in Madras in 1850, gave the following results:—The plantain, dry, broke at 2,330 pounds; after immersion in water twenty-four hours, tested seven days after, 2,387; and after ten days' immersion, 2,050; Manila rope and English hemp, dry, gave 4,669 and 3,885 pounds respectively. Though common plantain fibre is not possessed of the strength of Manila hemp, yet it is fitted for many purposes of cordage and canvas, and some of the finer kinds for textile fabrics "of fine quality and lustre."

Musa textilis.—Wild Plantain.—This plant, as well as the fibre produced from it, the celebrated Manila hemp, is called *Abaca* by the natives of the Philippine Isles. Other names are, however, given to the different qualities of the fibre, as *bandala*, which appears to be the harder and stronger outer fibre, which is used for cordage. The finer fibres of the inner layer are called *lupis*, and are employed in weaving delicate fabrics, while the intermediate layers furnish the *Aupoz*, which enters into the manufacture of the web-cloths and gauzes. The natives distinguish the several varieties of the plant as follows:—*Abaca brava*, or the wild *Abaca*, called by the Bicoles *Agotaï;* the mountain *Abaca*, which is used for making ropes, called *Agotag* and *Amoquid;* the *Sagag* of the Bisayas; the *Laquis* of the Bisayas, by whom the fibres of the original Abaca are called *Lamot.* The Malay name is *Pissang utan.*

The *Abaca* is cut when about one year and a half old, just before its flowering or fructification is likely to appear. If cut earlier, the fibres are said to be shorter but finer. It is cut near the roots, and the leaves cut off just below their expansion. It is then slit open longitudinally, and the central peduncle separated from the sheathing layers of fibres, which, in fact, are the petioles of the leaves.

The fibrous coats, when stripped off, are left for a day or two in the shade to dry, and are then divided lengthwise into strips three inches wide. They are then scraped with an instrument made of bamboo, until only the fibres remain. When sufficiently scraped, the bundles of fibres may be shaken into separate threads, after which they are sometimes washed, then dried and picked, the finest being separated by women with great dexterity.

After the fibre has been cleaned in this manner, it is ready for the manufacture of cordage, and for all purposes where a coarse fibre is employed. The fine fibre, however, which is to be used for weaving, having first been made up into bundles, undergoes the still further operation of beating, performed with a wooden mallet, which renders the fibres soft and pliable, The separate filaments are then fastened together at their ends by gumming; and wound into balls, which are then ready for the loom. Sometimes it is dressed like flax, on a kind of heckle, and afterwards washed many times in running water until perfectly free from all extraneous matter, after which it is hung over poles or ropes to dry.

M. Perrouttel, a French botanist, in the "*Annales Maritimes et Coloniales de France*," states that the *Abaca* of the Phillippines differs essentially from all the varieties of banana known. Its stem is 15 to 20 feet high, of a dark green color, and very smooth on its surface. Its leaves are of the same color, long, straight, with strongly marked nerves. The fruit is small and triangular, resembling abortive bananas, and scattered here and there near the extremity of the fruit-stem. The plant requires a rich humid soil, and flourishes in thick forests at the base of the mountains, where it acquires in a short time an extraordinary development. In regard to the capability of the *Abaca* for the manufacture of fine fabrics, the writer says:—" Of the finer sort tissues or muslins are made of great beauty, which are very dear, even in Manila. I had a number of shirts made from the muslin, which lasted me a very long time, and were cool and agreeable in the use. But it is especially in France that tissues of this material are best made and of the greatest beauty. They receive all colors with equal perfection. Veils, crapes, neckerchiefs, robes, and women's hats—all of great beauty and high cost, as well as of wonderful durability—are among the manufactures from the fibres of *Abaca*. Besides these are various articles of men's wear, such as shirts, vests, pantaloons, &c."

Another author mentions that beautiful shawls are made from it.

As late as 1872 no other method of extracting the fibre than the laborious scraping, described above, had been devised. Two men will cut and scrape about 25 pounds of the fibre in a day, the man that cuts the trees transporting them, stripping the layers, and cleaning the scraped fibre, though it is thought this is above the average. "From 150 to 200 trees are required to produce one picul, or 140 pounds of fibre, or 3,200 trees for a ton of 2,240 pounds." Thus an Indian prepares only about 12 pounds of fibre per day, for which he receives his half share, 18 cents, which is the value of 6 pounds of the hemp, "yet this insignificant pittance suffices for the wants of himself and family."

In this connection it is surprising, when so many hundred thousand bales of fibre are produced annually, and the scraping is comparatively such a simple matter in itself, that machines have not long ago been invented to meet the wants or requirements of the natives and those engaged in the hemp industry. There are no slaves on the islands, and the natives work on shares or as small proprietors.

The fibre is white and lustrous, easily separated, stiff and very tenacious, and also very light, which is a great advantage when the fibre is used for the rigging and running ropes of ships. Viewed microscopically the bundles of fibres are very large, but are readily separated into *smooth* fibres of even diameter, after the alkaline bath. The central cavity is large and very apparent, the walls being of uniform thickness. The ends taper gradually and regularly. The detached transverse sections appear irregularly round or oval in shape, and the central cavity is very open and prominent.

As to tenacity, compared with English hemp, it stands as follows:—A rope of Manila 3¼ inches in circumference and 2 fathoms long stood a strain of 4,669 pounds before giving way, while a similar rope of English hemp broke with 3,885 pounds. A second test of rope 1¾ inches in circumference, and the same length, gave 1,490 pounds for the Manila, and 1,184 pounds for the English hemp.

This fibre is imported in bales of 270 pounds, costing at present (January, 1880) 7½ cents per pound. In 1879 one New York manufactory used 41,366,710 pounds of this fibre, equivalent to 153,173 bales.

American-manufactured Manila for the most part goes into the rigging of vessels, or is used on shipboard, though it also finds use for every purpose for which rope is employed.

Musa Banksii, F. Muell. The Queensland Banana. A fine slender species; the fruit, called "Morgogaba," is eaten by the natives. With proper appliances the fibre of this plant might be made equal to the celebrated Manila hemp, the produce of *Musa textilis.*

PALMACEÆ.

Cocos crispa.—Coroja Palm.—Two varieties of Corojo are given in the catalogue of M. Bernardin, the "*Corojo de la tena*" from the West Indies, stated to be *Cocos crispa,* and the *Corojo, Corozo,* or *Cocoyal* from Central America, without name. Squier states that the Corosal, Coyal, or Corojo palm abounds in dry and rocky locations in Central America and Cuba, and some other portions of tropical America. It is described as a tree 20 feet high, producing a large cluster of nuts, with a hard shell, which yields an oil similar to that of the cocoa-nut. The trunk and leaves of the coyal are armed with long, narrow, hard spines. "The leaves are lined with a long and excellent fibre called *Pita de Corojo*, from which ropes and cords are manufactured. The fibres are equal to those of Henequen, from which they can hardly be distinguished."

The fibres, as examined, present a ribbon-like form, flat and smooth, and as thin as paper. By rolling between the hands, this ribbon breaks up into innumerable filaments, some of them of great fineness, though when viewed through the magnifying glass are found to be quite irregular in size, and not altogether smooth.

It might prove a valuable fibre for cordage, though a drawback (in the specimen examined) is the presence of little spines, doubtless those mentioned by Squier, which are as sharp as needles, and half an inch in length. They are not readily seen, but by grasping a handful of the fibre in the hand, they make their presence known with painful surety.

As to the fibre being "equal to Henequen, from which it can hardly be distinguished," the present fibre is far superior in point of strength to any other fibre, and in point of resemblance is in no respect like Henequen, either in color, texture, or general appearance. Its tensile strength with a lateral strain is simply enormous; by giving the fibre a sharp twist, however, it parts more easily.*

COCOS NUCIFERA.—There are many different plans of extracting the coir from the husk or covering of the cocoa-nut.

The finest quality comes in bundles, and is used for brushes.

The largest consumption is for matting.

In some places the husks, after being removed from the nuts, are allowed to soak in water for twelve months. To expedite the process in some parts of India the husks are soaked for a few weeks, then passed through rollers and again soaked; when they begin to soften the fibre is carded out.

At the request of Mr. Hinde some husks were put in the cylinder by M. Ekman, and they yielded in one hour a fibre that could be removed with the hand, the soft pithy waste disappearing. The fibre when dry was strong, and had a good colour. It is quite a mistake to suppose that the fibre can be simply extracted by boiling in water.

PANDANACEÆ.

Pandanus pedunculatus, R. Br. The Native Screw Pine of Eastern Australia. This interesting plant grows to a considerable height, and, like most of the Screw Pines, presents a novel appearance when seen in the natural state, from the fact that, unlike most other plants, it is forced out of the ground by the roots, which ultimately form a base above ground. The fibre obtained from the leaves and roots is very strong, and is prepared by boiling.

Pandanus Forsterii, Moore and Mueller. The Tent Tree of Lord Howe's Island, New South Wales. This species is not unlike *P. pedunculatus*.

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* U.S. Government Report.

FURTHER NOTES ON PLANTS.

INDIA RUBBER PLANTS.

As many growers of Rubbers have lately been writing to the papers concerning the extraction of the sap from their trees, I think that the following, which was forwarded by me to the Editor of the *Ceylon Observer,* will interest such of my readers who are cultivating Rubber plants:—

"I see that a question is asked on p. 450 in your weekly edition of the *Ceylon Observer,* as to the best manner of getting the India Rubber out of the different Rubbers of the 'Landolphia' species, and also enquiring when it is likely to come to maturity.

"I have studied the habits of the 'Landolphias' from the West Coast of Africa for about three years, and have taken every information I could gather respecting them, and after considerable difficulty, obtained one plant of 'Landolphia Kirkii' from Kew.

"This last plant has made its growth, and I can see that its habit is very similar to 'Landolphia Florida.'

"Because the Indians obtained the Rubber by tapping the trees, that is to say, by cutting holes in the bark and catching the juice, it is no reason why this course should be followed when it is necessary to obtain the juice from a different class of tree to the '*Ficus elasticus.*' If any of your readers who are growing the species of 'Landolphia' will take a dead bough or 'runner,' and cut it through the bark up to the stem, without quite severing the piece, they will find that it is full of gum, and so elastic in quality that if the woody piece of bark is separated and the gum fibre left, it will spring back to its former position, carrying the bark with it.

"This tree throws up every year runners from the roots, and in my opinion it is advisable that these should be allowed to mature, and that when they can be cut down, it will be necessary to find some process for extracting the Rubber from the dry bark or from the stems. With this aim I am trying some experiments, but I need hardly add under what difficulties I labour in this country, only being able to obtain such small pieces. I have written over and over again to the West Coast for branches and trees to be sent me, but my correspondents say that I have no idea of the expense and trouble of sending into the woods for these faggots, and then having to transport them through the surf to the steamers which lie in the roadsteads. There are plenty of substances that will melt the India Rubber, but the object is to find a chemical that can be relied upon, that when treated will return a commercial product in the pure state of 'gum elastic.'

"It must be also noted that if any experiments are made, the strength of the spirit should be recorded, for some strengths will melt the resins as well as the Rubber.

"Very little is as yet known respecting the Rubbers that come to the London market, further than that the merchants classify them as they can turn them to commercial purposes. I have placed before a man who knew Rubber at sight, three samples, all taken from the same tree, the juice or milk having been treated differently. He could hardly believe that the native form which he was accustomed to purchase could be so treated as to yield a clean clear gum. This proves what may be done by careful collection."

EAST AFRICAN RUBBERS.

Sir John Kirk exhibited at the Linnean Society a bell, with the beater, and on the end of the stick was a ball of india rubber twisted. He stated that this was the only use these natives put the rubber to. His experience is, that the *Landolphia Kirkii* juice hardens more quickly than any of the other East African rubbers he has met with. It is this rubber that appears in the market in the shape of long cones, for the film of rubber is wound into the form of a cone direct from the tree, reversing the action of a cocoon.

Now if the trees will only continue to bleed regularly, some simple machine can easily be invented to wind off this rubber and keep it entirely free from dirt and foreign substances. Upon the representation of Dr. Kirk, the Sultan of Zanzibar instructed his officers to issue orders to the natives and dealers that if any one was found adulterating the india rubber sent to market, that they should be severely punished. The Sultan saw clearly from the report of Sir John Kirk that the rubber from his dominion would get a bad name if it continued to be falsely made up with stones, rags, and clay balls—the natives know nothing of the civilised mode of manufacture, and they want something to start the ball upon when winding on the film of elastic gum.

Sir John Kirk's opinion is, that too much dependence must not be placed upon the cultivation of india rubber bearing plants to supply the demand for an insulating substance. The growth of all rubbers is slow and the yield small in proportion to the requirements of commerce. The natives in East Africa are fast destroying the old trees, and even cutting the roots, and not planting new ones. He exhibited stems of *Landolphia* 9 to 10 inches in circumference, showing the cuts on them from which the juice is collected.

The *Landolphia florida*, he said, would become a favorite plant in Europe as soon as its flowers were seen, their form and perfume being exceptionally fine.

At present orders are being sent out by merchants for the rubber seed; Sir John Kirk states that the natives go into the woods and collect all seeds they can find on the different varieties of rubber.

The consequence will be that planters will lose much time, after waiting for a good variety of plants, then to find out that they only have grown a worthless variety.

The paper furnished to the Linnean Society by Mr. W. T. Thiselton Dyer will be valuable as a guide to detect these plants by their foliage. Sir John Kirk attached little importance to *Landolphia Petersiana* or *L. Watsoniana.* How such names get attached to these rubbers it would be interesting to discover—because it would be much more useful to find a name expressing some peculiarity characteristic of the plants, flowers, or fruits.

Mr. Dyer has followed up the clue, given by the specimens of bark or stem of Totong that I exhibited at the Linnean Society in 1881, from Cochin China, and he has found out from Dr. Pierre that it is *Paramaria glandulifera.* I have received further specimens from other parts. It is said to be a drug shipped to China for smoking—no doubt Mr. E. M. Holmes will be able to follow up this clue—there is a quantity of elastic material in the dry specimens that come to this country.

PYRETHRUM.

P. roseum and *cinerariæfolium.*

I wish to call the attention of planters and persons living in hot climates to the value of this plant as an insect powder. It will be found especially efficacious in destroying mosquitos and flies when the crushed leaves are simply placed on the window, and will also have the effect to prevent these pests from entering any room thus protected. I should recommend its being largely grown in the colonies, as there is now a great demand for the powder, and the plant is not now cultivated to any great extent. The following particulars, which are given by Mr. C. Willemot, as to the cultivation of the plant, will prove useful to intending planters:—

" The soil best adapted to its culture should be composed of a pure ground, somewhat siliceous and dry. Moisture and the presence of clay is injurious, the plant being extremely sensitive to an excess of water, and would in such case immediately perish. A southern exposure is the most favourable. The best time for putting the seed into the ground is from March to April. It can be done even in the month of February if the weather will permit. After the soil has been prepared and the seeds are sown they are covered by a stratum of earth mixed with some vegetable mould, when the roller is slightly applied to it. Every five or six days the watering is to be renewed, in order to facilitate germination. At the end of about thirty or forty days the young plants make their appearance, and as soon as they have gained strength enough they are transplanted again at a distance of from fourteen to twenty inches, according to their strength. Each transplantation requires, of course, a new watering, which, however, should be only moderately applied. The blossoming of the pyrethrum during the second year, commences towards the end of May, and continues to the end of September."

Mr. Willemot also states that the plant is very little sensitive to cold, and needs no shelter, even during severe winters.

The directions quoted above have reference to the climate of France, and as the cultivation of the plant in many parts of North America is yet an experiment, a great deal of independent judgment must be used. The plants should be treated in the same manner as the ordinary asters of the garden or other perennial *Compositæ*.

In a closed room the fumes of a small quantity of the plant will soon kill or render inactive flies and mosquitos, and will be found a most convenient protection against these last when no mosquito bars are available. A series of experiments made under our direction indicates that the fumes affect all insects, but most quickly those of soft and delicate structure.

This method is impracticable on a large scale in the field, but will be found very effective against insects infesting furs, feathers, herbaria, books, &c. Such can easily be got rid of by enclosing the infested objects in a tight box or case and then fumigating them. This method also proves useful in greenhouses, and, with suitable instruments, we see no reason why it should not be applied to underground pests that attack the roots of plants.

Pyrethrum is also applied successfully in the forms of alcoholic extracts, water solution, tea or decoction for destroying cotton worms, and the armoured scale bug of the orange and lemon, which falls off in the course of two or three days after the application. As the infusion, unlike whale soap and other washes, leaves the foliage perfectly clean, and does not injure even the most tender growth, it is preferable on that score alone; and in the future it can hardly fail to be the cheaper of the two. This is the more likely, as the tea made of the leaves and stems has similar, although considerably weaker, effects; and if the farmer or fruit grower were to grow the plants, he would save all the expense of harvesting and grinding the flower heads by simply using the header, curing the upper stems, leaves and flower heads all together, as he would hops, making the tea of this material by the hogshead, and distributing it from a cart through a syringe. It should be diligently kept in mind that the least amount of boiling will seriously injure the strength of this tea, which should be made with briskly boiling water, but then simply covered over closely, so as to allow of as little evaporation as possible. The details of this most economical and effectual use on the large scale remains, of course, to be worked out by practice."

To give a singular instance of the action of "Pyrethrum," or "Dalmatian Insect Powder," an old-fashioned house, fitted with hot water pipes, swarmed with cockroaches and beetles. The powder was strewn on the floors of the kitchens just as the servants were leaving for the night. In the morning the stupefied beetles so covered the floor that a wine glass could not be placed on the ground without touching an insect. The insects were carefully swept up and burnt; but during the day more kept coming from their hiding places, and had to be swept up and burnt.

I think that this is a pretty good criterion of the effect of this herb upon certain insects.

YARKASURA NUTS.

These nuts, of which I am at present unable to give the name, are said by the natives of Col~~u~~ombia to possess the property of curing the worst cases of ringworm; the first application removing the irritation and the inflamed circle assuming a dark appearance, and the second or third application causing it to scab and disappear. The Indians also use the nut for cutaneous disorders, and apply it by rubbing it on the parts affected.

I have a small quantity of these nuts coming over, and shall have them tested as to their medicinal properties, and shall also raise a few of the plants, if the nuts are fresh enough, so that the plant may be identified. The following article appeared in the *Field*:—

> In my last notes I omitted, when speaking of a place called Yarkasura, to mention a very valuable production which grows there. I fancy it is found also in other parts of the colony; but, as I have only seen it brought from there, I give it the name by which it is known in the

neighbourhood. I allude to the Yarkasura nut, which is a most rapid and certain cure for ringworm and skin diseases of that class. These nuts grow on a large tree in pods of a foot long, and about sixteen inches in circumference, and are, in fact, the kernels. One pod contains several of these kernels, no two being of the same size or shape, but varying from one to two inches and a half in length, and of a brown colour. I have frequently applied a small quantity of powder scraped from one of these nuts, mixed with crab oil, to bad cases of ringworm, the first application removing the irritation, and causing the inflamed circle to assume a dark appearance, and, after the second or third to scab away and disappear. Our boat hands told me that the Indians carry this nut about with them, and rubbed their bodies with it when affected with the cutaneous disorders to which they are very subject, using it without scraping. I found crab oil the best to mix the powder with, as the ants are apt to follow an ointment made with lard and sweet oil, while the crab oil, which is made from the nut of the crab tree, is so bitter and acrid that no insect will approach it, not even mosquitoes. I have frequently smeared my hands and face with it while out shooting, with the mosquitoes swarming about me, and been untouched by them. G.

TURKISH TOBACCO.

There is no doubt but that the demand for high-class Turkish tobacco with the aroma and perfume will always command a high price—very little of the best quality comes to England. The seed I have sent to many places in Asia and America, but the leaves grown from it have not been of much value. The experience of many planters, who have watched the results, is that the earth or soil governs the flavor in Tobacco culture.

The report of Acting Vice-Consul Pecchioli, of Cavalla, where the highest quality of Tobacco is produced, is annexed.

I have a good supply of this seed, so that anyone who wishes to send some to their estates abroad can do so. In No. I, "New Commercial Plants," a full description of the cultivation and mode of curing the leaf can be found.

Report by Acting Vice-Consul Pecchioli on the Trade and Commerce of Cavalla for the Year 1878.

Exportation.

The harvest of tobacco in all the Sandjak sometimes reaches the important sum of 6,000,000 okes; but in general the quantity varies between 3,500,000 and 5,000,000 okes. The Government until about three years ago sold the dimes of cereals and tobacco; but since then its own officers have levied these taxes for Government account through a separate administration.

The qualities the most sought after and appreciated by connoisseurs of tobacco are those of the Caza of Yenidge, the other side of the

Vardar river (Nestus). After these come, always diminishing in quality, the tobacco of Drama, Persoccian, Parishaban, Cavalla, and Pravista.

CONSUMPTION OF TOBACCO.

In regard to the quantity consumed, the two "regies" (or Government monoply) of Austria and Hungary buy the greatest and the most choice of this produce. It is reasonable to calculate that 40 per cent. of Yenidge and Drama tobacco is sent to Austria and Hungary.

A very considerable quantity of good tobacco is also sent to the markets in Russia and Constantinople. France buys very little; and Italy, through the "regie," takes annually a part which varies between 150,000 and 200,000 kilos. Very inconsiderable quantities are sent to Germany and Switzerland. Some years a more important quantity is sent to Wallachia.

TRADE OF TOBACCO WITH ENGLAND.

In the exports of tobacco England takes every year about 10,000 bales—that is to say, 400,000 okes of Pravista tobacco, a light-coloured tobacco without aroma (or perfume). This tobacco, calculating its cost price and the manipulation in the manufactory, costs the merchant 5 to 5½ pias. (the Turkish pound at 100 pias.) per oke, and is sold in London from 5½d to 8d the pound (150 Turkish dr).

The profits made by the merchants in their trade of tobacco with England are not great; but they have the great advantage of being able to draw for the half of the value on shipping the merchandise, so that even those with little capital can buy largely, because the peasants are content to receive the value by instalments during one year and sometimes much longer.

PRICES OF TOBACCO.

The dearest quality of tobacco is that of Yenidge, sold for as much as 80 pias. per oke, without being manufactured. After comes the tobacco of Drama, which costs 25 to 28 pias. per oke; Persoccian, 18 to 20 pias.; Cavalla, 14 to 18 pias.; and Prevista, 4 to 5½ pias.

The more ordinary qualities of tobacco and the leaves which remain after the work is over (called "refusa") are sent everywhere, at the price of 1 to 2 pias., and enter into the manufacture of cigars and cigarettes at Constantinople and all the towns of Turkey, and are sent with the same object to Russia, Germany, Roumelia, and London.

Latterly for some years the price of tobacco has been rising very considerably. Tobacco at Cavalla which cost ten years ago 6 to 8 pias. is now sold for 20 pias. This year tobacco is very dear, and has never before fetched such prices.

THE TUBEROUS-ROOTED VINE OF COCHIN CHINA.

Owing to the alarming ravages caused by the Phylloxera in the vineyards of France, attention has forcibly been turned, not only to discovering the means of checking its career, but also to experiment and introduce new varieties of vines likely to prove antagonistic to the parasite.

Through the kindness of Messrs. Vilmorin, Andrieux & Co., of Paris, I am now enabled to bring under the notice of my readers a vine from Cochin China, which, in the opinion of Mr. Martin, Head Gardener of the Government Gardens at Saigon, if properly treated, should prove a valuable acquisition to vine growers.

The following particulars concerning the vine have been translated from a letter received by Messrs. Vilmorin from Mr. Martin :—

I found this vine, the existence of which I was not aware of, in the forests of Mois, in September, 1872. The fruit being plentiful and large, I at once extracted the juice and made the wine, which to me seemed satisfactory, but upon being told that it would not keep, for that year I decided to make a good vinegar from it.

In the meantime I turned my attention to the existence of the vine in Cochin China, where it is found largely in all the forests in the East, and even in the dry parts of the districts of Havinh, Hation, Rachgia, Cape St. Jaques, on all the islands around Cochin China, in the Mois and Cambodgia. I found several varieties of white, and also of red grapes. After reading the accounts given by the late Mr. Lecard of the vine he had met with during his travels in Soudan, and comparing its characters with those of the vine which grows here, I have come to the conclusion that both are identical.

The vine likes a light and fresh, or a clayey or rocky soil, and will not interfere much with plants grown in its immediate vicinity. It will thrive well in shady places in forests, so could be cultivated on trellis-work to advantage. The ground, before planting, should be broken up, and trenches made, so that the extremity of the sets are at about 3 or 5 inches from the surface, for if placed on the level of the ground the plants will not develope their roots in a satisfactory way. It should be trained in a similar way to the hop, with sticks for the branches to climb on. I do not, however, think that this vine will attain the same height in France as it does here, where it reaches as much as 60 yards, and is covered with fruit from the base to the top of the branch.

I have observed that by careful cultivation and cleaning, its condition is greatly improved, the grapes become much larger, sweeter, and more juicy.

In Cochin China its first shoots appear in March and April, and its flowers at the end of March or beginning of April; the fruit commences to ripen early in September, and continues to the end of November.

It produced very large tubers, so I should recommend it to be cultivated in the same way as the vine that produces the white wine in certain districts in France, *i.e.*, on sticks. The latter should be at least one metre apart.

The wine is of a fine green colour, but this is no doubt owing to the want of lime in the soil, for when I placed a small quantity of lime a few feet away, the fruit was sweeter and nicer, and the wine richer by one degree than if made from grapes taken from the uncultivated vine.

Last September (1881) I placed in a tub about a hundred kilos of the unripe fruit, this gave me a colored wine, but with the odour of "verjuice." Having been able to prevent this wine from turning, I sent some to the Governor, who appreciated the result, which, so far, was pronounced as quite satisfactory.

I had the wine analysed, it proved good, but very poor in alcohol, containing not more than 5 degrees per cent.

I tried making the wine from the ripe and sorted fruit, and fermentation set in with great rapidity after the fruit was crushed; at the end of 48 hours the upper part of the vintage soured, and fermentation decreased, leaving a limpid and very deeply colored wine, tasting still a little sweet, but agreeable. It would not have been advisable to allow fermentation to continue in the tub, as it would simply have been anticipating acidity, so I decided to draw the whole off and allow it to ferment without air. All went nicely for a day or two, the sugar decreased, and the quantity of alcohol increased, but the third day the process of fermentation became irregular, the odour becoming very disagreeable, in fact, the same phenomena occurred as in my previous experiments; I therefore had resource to the same process, that is, by heating to 131° Fahr. (Pasteur's system), and the wine proved quite drinkable, though it contains now, after keeping very well, only about 5° of alcohol. You are no doubt aware that the agents of fermentation are distributed in the atmosphere in the state of germs, and that they deposit themselves, if favorable circumstances allow, on the exterior parts of the plants, of which they are to transform the juice. As regards the grape, one has to deal with several microscopical vegetables. In the first instance the *Mycoderma vini* and *Aceti;* secondly, two or three infinitely small *cryptogams*, which determine diseases in wines; therefore, should the constitution of the centres influence the development of one or other of the germs, the temperature of the juices to be fermented favors one more than the other.

In France, at the time of the gathering of the grapes, the temperature scarcely exceeds 68° Fahr. at day time, and 44° to 46° Fahr. at night. Under these circumstances, very favorable to the germination and reproduction of *Mycoderma vini*, which, as a rule, developes alone, with the exception of a small amount of *Mycoderma aceti* in the upper part of the tubs, if there is any disturbance of the air and therefore a flow of oxygen coming into contact with the juices under fermentation, the transformation of the juices into alcohol takes place very slowly and regularly; then comes the drawing off, and the repeated fining causes the disappearance of the majority of dangerous germs, which only awaited a favorable opportunity to develope themselves.

In Cochin China, at the time when I conducted my experiments, the temperature of the vintage always remained at 82° to 86° Fahr. Notwithstanding the fermentation of the wine being more rapid in its principles than the fermentation which I shall call hydro-carbonic, the wine was made in quite normal conditions.

From the above it will be seen that this vine can be easily cultivated, the only soil it does not favor being a damp or marshy one. It will thrive in fresh or dry land, and the quality of its fruit, by careful cultivation, will improve very much, as well as its wine in color and alcohol. In the opinion of Messrs. Vilmorin, this vine will only be cultivable in the southern parts of France, Italy, Spain, in Algeria, Egypt, and other hot or tropical countries.

With reference to the raising of this vine from seed, Messrs. Vilmorin recommend that before sowing it in the hot-house or frames, the seed be soaked for several days in tepid water (warmed in the sun) and often renewed, as by this means they were able in about two months to raise about 40 per cent. of the seeds in a house where the temperature was maintained at from 68° to 77° Fahr.

The remainder of the seed, they say, has not shown any sign of germination, and it is likely that it will not do so before the spring of next year, thus proving that the seeds are very slow to sprout, in fact, many who have sown them have not seen any signs of life in the seeds until twelve months after.

I have secured a few seeds of this vine, which I am growing at Sydenham, and shall compare the plants most carefully with those I have raised from seeds sent to me of the Soudan vine.

KOLA NUT.

Although the Kola Nut, also called the Gourou or Ombené Seed, has long been known, it has only recently been submitted to a careful chemical investigation. M. M. Heckel and Schlagdenhauffen (*Comptes Rendus*, March 20th, p. 802) point out that this seed is richer in caffeine than the best coffee, and that the alkaloid exists in it in a free state. It contains, in addition, the same alkaloid as cocoa, viz., theobromine, and a considerable quantity of glucose. It has the advantage over cocoa of containing but little fatty matter, and three times as much starch as cacao beans. As the fat is generally removed from cocoa, and starch of some kind added, it is obvious that we have here a product which combines the best qualities of coffee and cocoa, and which might therefore form a most valuable basis for a new beverage, which, if appropriately treated and flavoured, might even supersede to a certain extent coffee and cocoa. Under such circumstances, the cultivation of the plant might form an important source of income.

CINCHONA.

The last shipment of Calisaya Verde which was dispersed has given results entirely satisfactory, as far as the germination of the seed is concerned, and two or three parties who have sown it, consider that nearly every seed germinated. This was specially the case with some of the seed given to Mr. J. E. Howard, who has examined my specimens of the Calisaya Verde bark. Mr. Howard considers the importation of the seed of extreme importance, as it is a most valuable kind of Cinchona for plantations, and one likely to pay the planters well. The seed has not to his knowledge been imported to this country before, nor had he a plant of the Verde variety in his greenhouses.

Many planters have asked me to try and find out at what elevation this Cinchona thrives best, and this I am endeavouring to ascertain.

One of the planters who has studied the growth of Cinchona in Bolivia informs me that he finds, as a rule, the trees that have a "velvety" leaf yield the largest quantity of quinine. In the shipment advised as *en route*, care has been taken to separate some of the varieties, but as the seed is only collected from the best yielding trees, in the shipments that have been distributed, no one will suffer from finding that they may have more than one variety of the plant come up.

The correspondence in the *Ceylon Observer* seems to point out the fact that from seed collected in India and Java, not much dependence can be placed upon the variety of Cinchona plant that will be produced from the seed sown. "Some people in Java think Ledgeriana seed worth not a little--£236 an ounce! Such is the tenor of a mercantile advice which states that for a small quantity of Calisaya Ledgeriana Cinchona Seed of a superior kind from trees of a good age, the bark of which has been chemically tested, as much as 100fl. (£8 . 6/8) per gramme of 3,000 seeds is asked. As the ounce contains 28·34 grammes, this is at the rate of £236 per ounce."* It is now selling in Ceylon at 30s. per oz.

I hope shortly to be able to deposit in the Museums in Ceylon, and also at Kew, specimens of some of these valuable South American barks. I should have done this before, but I have only one specimen of each variety. The leaves that have been sent over, after being examined by Mr. J. E. Howard, have been placed in the Pharmaceutical Society's Museum.

CUPREA.

(*Remijia pedunculata. R. purdieana*).

Having received a small packet of this seed, which has germinated well, the plants will be of sufficient size to distribute to the

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* "Tropical Agriculturist," July 1st, 1881.

Botanical Gardens shortly. I shall give some specimens to Dr. Trimen for the Gardens in Ceylon, and to Mr. D. Morris, in Jamaica, so that they can test its value and see if it improves by cultivation. At present only the best varieties of the Cuprea bear a good name as a commercial product, the best only yielding 2 per cent of sulphate of quinine.

MENTHOL.

(*Mentha species*).

I have received from Japan some roots of the plant yielding the Menthol crystals. They are growing well, and as soon as they show signs of flowering they will be examined botanically.

The trade in this drug is increasing daily, and I can see no reason why this plant should not grow in this country, and I think from the quantity of plants that I have under cultivation, it will be possible to put it to a thorough test.

In my next number I hope to give details of the order of plants yielding this drug.

ECONOMIC PLANTS.

The following reports have been published by Dr. Duthie since "*New Commercial Plants,*" No. III.

ARGAN TREE (*Argania Sideroxylon*).—A packet of seeds of the above named tree was received from the Director of Agriculture and Commerce North Western Provinces and Oudh. Out of the 47 seeds which the packet contained 9 germinated. The plants were about 3 inches high when the rains set in, and being then in a very succulent state, every one damped off and died. Another lot of seed has lately been received from Morocco, through Monsieur A. De Scala, Director of the Oriental Museum, Vienna, and should they germinate, special precautions will be taken to protect them as much as possible from damp.

LALLEMANTIA IBERICA.—This valuable oil plant promises to be a success grown as a cold weather annual. A very small quantity of its seed was received last year from Vienna. From this sufficient stock has been raised for growing it on a larger scale next cold season.

ARRAÇACHA ESCULENTA.–The seed of this new kind of vegetable from the Andes, an account of which was given in my last report, was sown in this garden. The result is 11 plants; none are sufficiently grown yet to say more of them than that they look quite healthy.*

GERMINATION OF SEEDS.

It very often happens, when valuable seeds, particularly small seed like the Cinchona, are placed in the earth, that weeds spring up and choke these seeds before they have any chance of getting free from the ground.

To avoid this I find it an excellent plan to burn the earth that is going to be used for planting them in. This is easily done by forming a small mound of wood and igniting it, and when there is a good red fire, throwing upon it lumps of earth, then another tier of wood, and another covering of earth. This earth must be finely pulverised before being used. The consequence is that the seeds get a good start before any of the wild plants have a chance of springing up.

There is much more importance in the germination of seed than many people attach to it. For instance, I took some Cinchona out of a packet that had arrived, and handed it to three men. One lot of seed came up as thick as it was possible to be, hardly a seed failing to germinate. The second man's pan had a fair sprinkling of young plants, but the third man's pan had no signs of any Cinchona plants in it at all. All these men were professional gardeners, and nothing was said to them about the experiment; each did his best.

Another interesting experiment I made was this. I planted seeds in three different sorts of earth. In one pan I placed a layer of burnt earth, finely pulverised. On this I placed the seed and covered it with finely pulverised burnt earth. I took care not to plant the seeds too closely together, so as to prevent their crowding one another out.

The consequence was that I got a splendid crop without any weeds whatever. Planters, when they are going round my hot-houses, point out old pans that they see covered with fern and "lichen," and they tell me that these are their pests in the East when planting seeds, and they did not before know how to prevent its growth.

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* The roots, which are large and divided into several fleshy lobes like a carrot, have, when boiled, a flavour intermediate between a chestnut and a parsnip. It might be tried in some of our Colonies with advantage.—*Treasury of Bot.* p. 93.

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NEW DRUGS.

PAPAW.

(Carica Papaya.)

The drug, obtained from this tree, is growing in favor, and excellent reports are coming from Germany. Prof. Rossbach's book is looked for with great anxiety. I have tested many samples of the dried milk, and they differ considerably; some arrive in a semi-liquid state, and are next to useless.

In the *British Medical Journal*, May 20th, 1882, the following account of the treatment of chronic eczema with this drug is given:—

> The so-called papaine, the partially purified extract obtained from the papaw tree, was recommended at the International Congress last year as a solvent of diphtheritic false membrane. I have lately been using it as a local application in old-standing cases of chronic eczema, more especially of the palm. As it is used in the West Indies to soften tough meat, I thought it might be of service in cases the chief feature of which is thickening and hypertrophy.
>
> It would occupy too much space to discuss the method of action here; it will be sufficient to say that it is supposed to digest certain substances by means of a special ferment. Roughly speaking, it may be said to resemble pancreatine. I have had such marked success with it, that I recommend it to the profession as a remedy worthy of trial in cases which often resist all the ordinary modes of treatment.
>
> The following brief notes of a case recently treated may be of interest. Mrs. R. was sent to me by Dr. J. E. Pollock, last June. She was suffering from severe chronic eczema of both palms, which completely resisted the external use of tar and mercury ointments of various kinds and strengths, as well as a six months' course of arsenic, and was only slightly relieved by prolonged soaking. On April 18th, I ordered 12 grains of papaine and 5 grains of powdered borax, in two drachms of distilled water, to be painted on the parts twice daily. When seen on May 9th, the hard horny masses of heaped-up epidermis, which were present on April 18th, had entirely disappeared from the skin, covering the heads of the metacarpal bones, leaving its texture quite normal. The fissures of the central portion of the palms had quite healed, and the cuticle was softened and pliable, though still showing signs of roughness.
>
> The patient stated that the application produced only a slight pricking and tingling sensation. No internal remedies were given. The borax was added with the view of checking fermentation, and supplying the alkali required in order to obtain the full action of the drug. In some other cases of chronic eczema and psoriasis, the same benefit has followed in as short a time as in the case above mentioned.
>
> *63, Montagu Square, W.* MALCOLM MORRIS.

He also writes to the same Journal of June 3rd, p. 845, as follows:—

> SIR,—Will you kindly allow me brief space to answer several correspondents who have written to me privately about Papaine? It is to be procured from Messrs. Christy & Co., 155, Fenchurch Street, E.C. The parts under treatment should be washed with soap and water once daily, but care should be taken not to use too much friction, as the skin is apt to become tender. I am now using the drug with considerable benefit in a case of severe warts. I find it also of use in softening hard corns.

Having had the dry milk of Papaw tested, I find that the proportion of Papaine to the ounce of the dry milk is about one-sixth, therefore those who prefer using the latter can do so upon this scale. I have asked Mr. Malcolm Morris to kindly try this dry milk in lieu of Papaine, and have no doubt he will soon be able to record his experience.

Surgeon B. Evers, in an interesting paper which appeared in 1875, in the *Indian Medical Gazette*, says:—"In Barbadoes the farmers mix the milky juice with the drinking water for their horses, for the purpose, as they express it, to break down the blood; and this is a remarkable fact, that the effect of this dissolving power in the fruit is not confined to muscular fibre, but acts on the circulating blood. In 1866, when I visited the Island of Barbadoes, I found that the unripe fruit, pickled, was largely used as an article of diet. In India it is not only eaten pickled, but also curried. I can assure my readers that the unripe fruit makes a very palatable *chijki* (vegetable curry) . . . . Mashed up with hot water the pulp of the unripe fruit might be applied as a poultice over the enlarged gland" (spleen).

The following interesting communication on the digestive properties of this drug was made to the Berlin Natural History Society, by Herr Wittmack. He said "that after repeated incisions of a half-ripe fruit he obtained only 1.195 gram of white milky juice, of the consistency of cream. This dried in a watch glass to a hard vitreous white mass; the odour and flavour of the fresh juice was somewhat similar to those of petroleum or vulcanised rubber. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments, made without the juice, the boiled meat was visibly harder. Hard boiled albumen, digested with a little juice at a temperature of 20° C. could after 24 hours be easily broken up with a glass rod. Fifty grammes of beef, in one piece, enveloped in a leaf of *Carica Papaya* during twenty-four hours at 15° C., after a short boiling, became perfectly tender. A similar piece, wrapped in paper, and heated in the same manner, remained quite hard."

The following is an extract of an article on the papaw tree which appeared in the Padang *Handelsblad* of the 16th Feb.:—

The *Carica Papaya* (in Javanese *Kates*; Malay, *Pisang Pelo*; and Nias, *Bala*) is a tropical plant which, on account of its hygienic properties, has, of late, been attracting the attention of medical men. If it be true, of which we have no doubt, that the juice of the *papaya* tree possesses digestion-promoting properties, every one who stands in need of it should give the preference to "papaine," the vegetable pepsine, prepared from *papaya*, over the animal one, which those aware of its origin may find difficult to swallow. The papaya is a handsome tree, which may best serve as an ornament to gardens, where, however, it allows very little room for the growth of shrubs and bushes, from its absorbing an incredible quantity of moisture. When not topped, its cylindrical stem attains a height of 10 to 20 feet, crowned by a number of large leaves. The flower unfailingly becomes a fruit, so that, almost daily, every period of growth from the bud to full ripeness may be observed on the papaya tree. Native cookery comprises several different kinds of tasty *curries* and *sambals* prepared from the unripe but not too young fruit of the papaya, while, as dessert, the ripe fruit, in its turn, affords us that relief alleged to be given by vegetable pepsine. The seeds are sometimes taken as a remedy against worms. The effects brought about by the use of the leaves and flowers of the papaya are again confirmatory of whatever has been written in recommendation of pepsine, for those who have experienced them can bear witness that these leaves and flowers actually possess digestion-promoting properties. Hence the natives make frequent use of dishes prepared from the papaya, especially those who consume much animal and heavy food. It is, however, less to be recommended for persons of weak constitutions, because on them, after use, the papaine works in a disquieting manner, bringing on diarrhœa, which sometimes may degenerate into dysentery. This may serve as a warning. From the stem as well as from the blossoms and unripe fruit of the papaya, a milky juice may be obtained, which, after being exposed a short time to the air, coagulates. Both in a fluid and coagulated state it causes a burning sensation when placed on the unprotected skin, followed, not unfrequently, by blisters. Should, by ill-luck, a single drop of it fall into the eye, total blindness is the unavoidable result. This fluid has been used with remarkable success in rooting out corns and warts. If the stronger outward portions of our bodies are so greatly affected by the raw, unprepared juice, what may not be the consequence of injudiciously administering and using it? One comfort remains, however, to us. The ripe fruit of the papaya is a sovereign remedy against dysentery. It is a native remedy (hence, probably, despised on that account) but the writer has experienced its healing powers. Not very long ago, a schoolmaster here laid many parents under deep obligation to him for curing their children suffering from this dreadful disease, and whose recovery the doctor in attendance had despaired of more or less, solely and exclusively by administering to them ripe papaya fruit. Whether this doctor profited by it is doubtful. At least the remedy has not yet been made widely known. Yet it is an efficacious remedy. A decoction of papaya leaves is also a wholesome medicine in obstinate inward fevers. A friend of mine, the late Mr. Ahrens, was once fully cured by means of it. That it is an exclusively native remedy may be inferred from the fact that it was prescribed for my friend by his mother-in-law (a native), and that the doctor in attendance stopped his visits on it being administered, on the ground that he would not be a witness to the death of the patient in consequence of the use of the papaya which he had been consuming. The root of the papaya, rubbed fine and laid as pap on the forehead, has been used with good effect against acute headache. It is also an excellent substitute for *akar kelor* in foot baths, and likewise does duty for mustard plasters, when prescribed.

LYCOPODIUM.

(*Lycopodium clavatum.*)

Lycopodium has hitherto been used in medicine chiefly as "a dusting powder" for excoriated surfaces, especially the *intertrigo* of infants, and to parts affected with erysipelas, herpetic ulceration, eczema, &c.

It is sometimes used in the form of ointment. In Poland it is popularly employed as an external application in *plica polonica.*

It has, however, been used by Wedelius and others, and in later times by Hufeland, Jawandt, Rademacher, and Burser in the retention of urine and flatulent colic of infants, and in calculous complaints, hæmorrhoids, and gout of adults *(Pereira Mat. Med.,* vol. ii., part i., p. 69).

A tincture prepared from the spores of *Lycopodium clavatum* has long been used by Homœopaths, but hitherto the administration of the powder called Lycopodium, and which consists of the spores, has not been found useful by the medical profession in general. The reason of this is probably because the medicinal virtues of the drug reside in the oleaginous matter contained in the spores, and therefore any preparations which do not involve complete fracture or solution of the investing envelope, must be comparatively inert. To fracture the envelope of the spores, it has been found that two hours' trituration with sugar of milk is required, and that only the ethereal tincture dissolves the oleaginous matter.

Experiments made with this tincture have shown that it possesses a special action on the urinary organs and liver, relieving spasmodic retention of urine in children, and catarrh of the bladder in adults. The three great tracts of mucous membrane with their cutaneous continuations seem to be especially affected by it. Dr. Hutchinson found it quite a specific in some forms of dyspepsia. Dr. Bayes also speaks highly of it in constipation attended with flatulence, and in *enteritis* in infants caused by taking food which they cannot digest. Mr. Pope says that in old hepatic congestions he has found Lycopodium more useful than any other medicine. Dr. Mayhoffer found it of great service in chronic passive bronchitis, and in chronic pneumonia. Dr. R. Hughes has observed striking beneficial results in a carotid aneurism resulting during its use, the shooting pains disappearing in the first three days after taking it, and in a fortnight the enlargement of the artery was reduced one-half, at which point it remained stationary, giving no pain or inconvenience.

But the use to which I particularly desire to call attention, is the remarkable action of this drug upon boils, carbuncles, and papular eruptions.

> "Some fourteen years since, I suffered severely from boils, having many on different parts of the body, and could not get rid of them until my attention was directed by Dixon Hartland, Esq., M.P., to the singular properties of tincture of Lycopodium as a remedy for this complaint. I have since then seen it tried on children suffering from what are popularly known as styes on the eyelids, and which have been cured in a few hours. Finding, however, that this action does not seem to be known to the medical profession, having searched through various homœopathic works, in which it is recommended for other complaints, I can discover no mention of its use for boils. I have sent the tincture to the East to be tried on the natives on the plantations, where boils are of frequent occurrence.
>
> "Having found repeatedly such good results with this remedy for external boils, I have suggested to several medical friends a trial of it in internal abscesses and tumours, and look forward with interest to their reports on its value."

CARNAUBA.

(*Corypha cerifera,* Arr.)

Much attention has lately been given to the cultivation of this plant, which is commonly called the Wax-palm of Brazil. It yields a wax, which has for some time been used for making candles. The wax is harder than bees-wax, and its color of a dirty yellowish tint, which, owing to the want of a process of bleaching, has so far rendered it unsuitable for first-class candle manufacture; it is gathered from the young leaves, from which it is shaken off, then melted and run into cakes. Mr. A. Scott Blacklaw says that the wax is obtained by scratching the stem of the leaf, then hanging a cup under the scratched part to receive the wax, and that no preparation is required to mould it into candles. During his visit he was able to ascertain that the country people and hotel keepers burn no other candles but those made from this wax.

The fruits are bitter and much liked by the natives, and the upper part of the young stems of the plants yield a kind of sago. The leaves are used by the natives, from which they extract an excellent fibre for making hats, thatching, and clothing.

The wood, which is very hard, is utilised for cabinet-making, and is sent to this country for veneering purposes.

The root is recognised by the profession as an excellent purifying agent, and has been found valuable in diseases involving impurity of the blood; in fact, I am persuaded that if this drug is carefully tried, it would prove a formidable rival of sarsaparilla.

Carnauba root has also diuretic power, and has been tried with great efficacy in the cure of acute or chronic blennorrhœa. It is given in the form of infusion, decoction, or fluid extract.

The infusion is similar in color to that of the wild cherry bark, has an agreeable and slightly bitter taste, and an odour resembling that of sarsaparilla.

The supply of the root is almost unlimited, especially now the attention of the planters in Ceylon has been turned to the many advantages of the plant, of which every part has a recognised use.

The seed imported from Brazil has sprouted splendidly, and Dr. Trimen, of the Peradeniya Gardens, in Ceylon, is also testing its germinating powers.

I am having the seed over direct from a large grower in Brazil, and shall therefore be able to supply any orders which are sent me: the first shipment came in good order.

WHITE QUEBRACHO BARK.

(Aspidosperma Quebracho blanco.)

In No. 4 of this series I gave a few particulars as to the therapeutic value of the White Quebracho Bark in dyspnœa, emphysema, bronchitis, phthisis, and pleuritis, and according to the latest reports this drug has proved itself of great value in the diseases accompanied by shortness of breath. The following case, which is reported by Mr. F. A. Ramsey, M.D., of Knoxville, Tenn., U.S.A., in the *Therapeutical Gazette,* will speak for itself. Mr. Ramsey writes:—"Under the same roof with me is a lady who is a patient of as good a physician as this city affords. She has a chronic eruptive disease, at times involving her throat, and possibly her lungs. She is affectionate in disposition, but impulsive, and at times violently manifests displeasure. In such paroxysms she always has dyspnœa, formerly to the extent of occasioning blueness of the lips. Now she calls on my daughter for a dose of fluid extract of Quebracho. Before she knew of this agent she suffered almost constantly; now she says half a teaspoonful will give relief very soon, and enable her to meet and entertain company, and control without difficulty her children throughout the day. It is the only opportunity I have had to employ this agent. In this one person the effect is remarkable and positive."

Dr. F. Simon, of Nieto, writing to *El Genio Medico-Quirurgico,* Madrid, recommends Quebracho as a specific in dyspnœa, whether resulting from asthma, or chronic or acute affections of the respiratory or circulating systems, or when due to emphysema and pulmonary catarrh; he then gives details of six different cases in which he administered Quebracho with success, besides some interesting experiments made upon himself. He recommends the following formulæ:—

℞.—Tr. quebracho (1 to 10)	ʒ j.
Water	fl. ℥ iiss.
Syrup	fl. ℥ ss.

A tablespoonful to be given every four hours.

℞.—Dry ext. quebracho	gr. xxx.
Water	fl. ℥ jss.
Syrup	fl. ℥ j.

A teaspoonful every half hour, until relief is obtained.

Dr. Simon concludes by saying that Quebracho acts on the lungs as digitalis does on the heart, its action being immediate, and its effects safe, so far as he had observed.

Since publishing No. 4 of this Series, this bark has been thoroughly investigated as to its alkaloids and their chemical properties, by O. Hesse, who published his results in the *Annalen der Chemie,* vol. ccxi., p. 249, and from which I extract the following:—

"The tree yielding this bark belongs to the *Apocynaceæ,* and reaches from 18 to 30 feet, with spreading branches, not unfrequently bending downwards, and without much foliage. The leaves, which are small and narrowly lanceolate, end generally in a spine. The tree bears small yellow flowers, from which the fruit developes rapidly, forming large flat unsymmetrical capsules, containing within a hard shell numerous seeds, provided with membranous wings. The bark, usually yellowish-white, is smooth externally on young trees, while it is rough and fissured on the old ones; the wood is of the same color, but much harder than the bark.

"According to a communication received by O. Hesse, from Schickendanz, white Quebracho is successfully used in the Province of Tucuman against fever, whilst Penzoldt could not perceive in the bark collected by Schickendanz any antipyretic action, though he found it valuable in different forms of difficulty of breathing.

"The alkaloids occur in the bark combined with acid, and especially with tannic acid; the quantity, however, is not constant, amounting in the younger barks to as much as 1.4 per cent., whereas it falls to 0.3 per cent. in the older barks. There is a great difference in respect to the quality and quantities in different barks, some barks yielding six, and some only three per cent. of alkaloids, which are obtained by boiling the powdered bark with alcohol, distilling off the alcohol, and, after adding excess of caustic soda, extracting the residue with ether or chloroform. Upon evaporation of the solution a brownish residue is left, which, by treatment with hot dilute sulphuric acid forms a red-brown solution, that after filtration gives with excess of caustic soda a reddish-white flocculent precipitate of the alkaloids. From this precipitate may be separated the following alkaloids: aspidospermine, aspidospermatine, aspidosamine, hypoquebrachine, quebrachine, and quebrachamine, whilst in the case of barks of other origin not unfrequently one or other of the alkaloids is absent."

I will now give a brief extract as to the different chemical actions of the alkaloids, the full particulars of which were translated and published in the *Pharmaceutical Journal*, March 25th, 1882.

ASPIDOSPERMINE.—This alkaloid crystallizes in two forms, in colourless pointed prisms, and in delicate needles. The latter sometimes disappear on recrystallization, pointed prisms being formed; both can be exposed to sun-light for a month without losing their dazzling whiteness. They melt at 205° to 206° C. A small portion of the alkaloid, however, sublimes in delicate shining needles. At a higher temperature the alkaloid becomes brown, and is almost completely decomposed.

Aspidospermine dissolves rather freely in absolute alcohol, less freely in ether, ligroin and light petroleum spirit, and freely in benzine and chloroform. The alcoholic solution does not alter red litmus paper. It is lævogyre. Aspidospermine is an extremely weak base; it does not neutralize acids, and is partially withdrawn from its salts by ether, chloroform, and other solvents. This behaviour allows the possibility of withdrawing a small portion of the alkaloid from the bark by means of benzine and thus injuring its quality.

The following preparations were obtained from this alkaloid, viz.:—neutral sulphate; acid sulphate; neutral and acid oxalates; acid citrate; bibasic citrate and hydrochlorate.

ASPIDOSPERMATINE. — This alkaloid remains principally dissolved in the mother-liquor which results during the preparation of aspidospermine according to the first method; it dissolves freely in dilute acids, which it is capable of neutralizing. This property can be utilized in the separation of this alkaloid from aspidospermine.

Aspidospermatine crystallizes in the anhydrous state, and its composition corresponds with the formula C_{22}, H_{28}, N_2, O_2; viz.:—2 atoms of hydrogen less than aspidospermine. Apparently aspidospermatine forms with acids only amorphous salts. The hydrochlorate remains, upon evaporation of its alcoholic solution, as a perfectly amorphous brown mass, which is freely soluble in water and alcohol, but not in ether.

ASPIDOSAMINE.—The precipitate of alkaloid mentioned under aspidospermatine as resulting upon the addition of small quantities of ammonia, consists principally of aspidosamine. It dissolves freely in ether, chloroform, alcohol, and benzine, and is left as an amorphous residue on the evaporation of these solutions. In ligroin and light petroleum spirit it dissolves with great difficulty, and scarcely at all in water, ammonia and caustic soda. An alcoholic solution of aspidosamine has a strongly alkaline reaction, neutralizes hydrochloric and sulphuric acids, and tastes bitter. This reaction does not always take place; but it follows invariably if the alkaloid be dissolved in aqueous solution of chloral hydrate instead of alcohol.

HYPOQUEBRACHINE.—This alkaloid is a strong vegetable base, probably the strongest of the quebracho bases. It neutralizes hydrochloric acid completely, forming with it a yellowish solution, which, upon evaporation, yields a brown amorphous residue that is easily rubbed to a yellowish powder. This salt dissolves very readily in alcohol and water.

QUEBRACHINE.—The alcoholic solution of this alkaloid has a strongly basic reaction, and like all its solutions, tastes intensely bitter. The salts of quebrachine are advantageously distinguished from the corresponding salts of the other quebracho alkaloids by their crystallizability. Its salts are :—the neutral sulphate; neutral oxalate; neutral tartrate; bibasic citrate; hydrochlorate; hydriodate, and the sulphocyanide.

QUEBRACHAMINE.—This alkaloid was only obtained once, namely, in the examination of the quebracho bark sent by Schickendanz, and then unfortunately in such small quantity that its elementary composition could not be ascertained.

PHYSIOLOGICAL ACTION.—In connection with the peculiar action of the extract prepared from the white quebracho bark, which has been observed in various quarters during therapeutical experiments, it must be of especial interest to learn the physiological action of the separate alkaloids, especially since this extract appears to contain no active substance other than the alkaloids. Dr. Penzoldt has now more closely tested these six alkaloids upon cold and warm-blooded animals, and the principal points in the respective results are briefly summarized in the following:

All six substances in doses of 0·01 to 0·02 gram produce in frogs paralysis of the motor apparatus, first of the respiratory muscles, as well as the other muscles of the system, whilst the sensibility remains intact for a long while. The motor paralysis depends upon central causes in the case of the four alkaloids, aspidospermine, aspidospermatine, quebrachamine and hypoquebrachine. In the paralysis produced by aspidosamine and quebrachine, it appears as if an action similar to that of curare also came into play. It was found that the ligatured extremities remained entirely movable, or at least for a longer time than the others, and further, that the nerves of an unligatured limb were sometimes absolutely unexcitable and sometimes more weakly excitable than the limb on the other side.

Respecting the influence upon the heart (in frogs also) only quebrachine, aspidosamine, aspidospermatine and aspidospermine were tested. The result was that all the substances produced quickly an increasingly important slackening and finally a cessation of the heart-beats.

With small rabbits quebrachine in doses of 0·02 to 0·04 gram caused motor paralysis, injected into the blood vessels of the ear, and dyspnœa. Hypoquebrachine similarly produced difficulty in breathing and slight motor paralysis. Aspidospermine produced in larger doses (0·08 to 0·12 gram) considerable dyspnœa, as well as eventually indications of muscular paralysis. From aspidosamine and aspidospermatine, in doses of 0·02 to 0·04 gram, no action of importance upon the breathing or motor power was observed.

KAVA-KAVA.

(*Piper Methysticum.*)

In the *Practitioner* for March, 1882, Leighton Kesteven, M.R.C.S., Colonial Medical Officer, Levuka, Fiji, contributes an interesting article on the physiological action of the Kava-Kava, which I give in full, as there is much interesting information furnished as to the way it is prepared and consumed by the natives of Fiji.

It will be seen from the following report that this root has a peculiar action upon those who indulge in Kava drinking, for, writes Mr. Kesteven, it impairs the function of locomotion, and you have the curious spectacle of a man utterly drunk in his walk, while his intellect is unclouded—he is unable to control the movements of his legs, but is perfectly aware of his disability. The enamel formation is also very singular. The following is Mr. Kesteven's report :—

Kava is prepared by the natives of the Fiji Islands, from the yangona root (*Piper Methysticum*). This plant possesses properties which will, doubtless, bring it into use as an article of Materia Medica—indeed from casual notices in the few medical journals that I have seen in this remote region, I perceive that it has already attracted some notice. I have thought, however, that it might not be altogether superfluous that I might give a short description of its action, taken from personal observation upon kava drinkers, and upon patients to whom I have administered it experimentally.

The root only of the plant is used in the preparation of kava, the old and dried root being preferred, the fresh root having a rough and bitter taste. The general mode of preparation or "brewing" consists in its mastication to the state of pulp, subsequent trituration with water in a large wooden bowl (called the tanoa) and straining through a filter of fibres of the hibiscus. The resulting "brew," of a muddy brown appearance, is then fit for immediate consumption. It is quaffed from bowls of cocoanut, which, in common with the tanoa, acquire after a few months' usage a pearly enamel of a bluish hue. This surface, by frequent rubbing with a soft cloth, acquires a polish like glass—indicating, I should suppose, the presence of silica. This coating of enamel varies with the age of the vessel. On a tanoa which I possess, and which is some score of years old, the layer is nearly half an inch through its thickest part.

Kava is now prepared for Europeans by simply pounding, or grating; the former process of insalivation being thus dispensed with.

The general belief that kava has stupefactive, or intoxicating properties is incorrect. Its primary effect is stimulating, like coffee, but it certainly has no intoxicating effect whatever; indeed I should say that its effects are the reverse, clearing the head and sharpening the mental faculties. It is re-invigorating, and I know of no draught more refreshing in fatigue from bodily exertion. It exerts a powerful action upon the salivary glands, speedily and effectively allaying the thirst incident to hot climates.

A night's carouse, however, from kava, as frequently indulged in by the natives, impairs the functions of locomotion, and you have the curious spectacle of a man utterly drunk in his walk, while his intellect is unclouded—he is unable to control the movements of his legs, but is perfectly aware of his disability. When the effects have passed off, there remain no after consequences, *e.g.*, "hot coppers;" "sore heads" are unknown as a result of kava drinking. Deducing from these facts a direct action upon the spinal cord, I have used, with decidedly beneficial effect, a concentrated extract of this root, in several cases where I suspected congestion of that portion of the nervous centres.

The bodily temperature is not increased by the action of kava, it has only a slight influence over the pulse, which, however, it somewhat steadies. Its action upon the intestines is constipating. I have thought that I have seen "liver complaints" induced by habitual kava drinking, but my experience under this head is incomplete. Old and inveterate kava drinkers have a belief that the eyesight is injuriously affected by a continual indulgence in its use, but I have not had sufficiently long observation for confirmatien, and have, as yet, seen no evidence thereof.

The most marked and valuable property of kava is its action upon the genito-urinary tracts. Chronic gonorrhœal gleet I have found yield readily to its effects, and in chronic cystitis it possesses an influence superior to any other remedy with which I am acquainted.

Dr. W. B. Kesteven supplements this report by saying:—

To the above I may add the description of "Yangona Brewing" given by Miss Gordon Cumming in her charming book, *At Home in Fiji.*

"The root is scraped and cleaned, cut up into small pieces, and distributed to a select circle of young men to chew. The operation is not *quite* so nasty as might be supposed, as they repeatedly rinse their mouths with fresh water during the process, which occupies some time, while all the company sit round most solemnly and sing some quaint *mékés (i.e.* choruses) very wild and characteristic. . . When the chewing process is completed, each man produced a lump of finely chewed white fibres. This is then deposited in a large wooden bowl, and one of the number is told off to pour water on the yangona and wring it out through a piece of netting of hibiscus fibres. A turbid yellowish fluid is produced, in taste resembling rhubarb and magnesia flavoured with sal-volatile."

Miss Cumming's account of the effects of kava differs very little from the preceding. Some white men drink it, and declare that made from grated yangona is not comparable with that which has been chewed. "Gentlemen," adds Miss Cumming, "say that when they have had a long day of hard walking, they are thankful to the native who brings them this, the only stimulant which he has to offer, and that its effect is like sal-volatile." The influence on the muscular system this lady also describes in much the same terms as those used by my son, which I would compare with the phenomena of loco-motor ataxy.

The climate of Fiji is so relaxing and debilitating, from the combined effects of heat and moisture, that few Europeans can stand it. My son will, I fear, be obliged to leave, having himself and family suffered from dysentery, erysipelas, abscess, boils, Fiji sores (ulcerations), low fever, and asthma!

I will now give my readers a few particulars of the use of this remedy in various diseases, and I think that the results obtained are satisfactory enough to recommend its adoption by the profession in this country.

Dr. Boardman Reed, Atlantic City, N.J., records in the *Therapeutic Gazette* four cases of (apparently) incipient gonorrhœa treated as follows :—

Ext. kava kava.	fl. ʒ v.
Glycerinæ, q.s. ad	fl. ℥ ij.

M.S.—A teaspoonful to be taken in a full tumbler of water after each meal.

The patient was directed to take, in addition, a large teaspoonful of Rochelle salt in a tumbler of water every morning before breakfast, and to use the mildest possible local application. All stimulating drinks or foods, including condiments, were forbidden, and the patient directed to take as little exercise as possible. In each case the symptoms entirely disappeared in from three days to a week. In cases which had advanced to the second stage no good results were obtained from the use of the remedy.

Dr W. Semple, of New Liberty, Ill., U.S.A., combined Kava-Kava with tincture of aconite or gelsemium, or in some cases both, and found it of the greatest value in acute gonorrhœa and gleet. In leucorrhœa he found the following very successful :—

℞.—Fl. ext. kava kava.	℥ ij
Fl. ext. berberis Aquifolium	℥ j
Iodide of potassium	ʒ j
Simple syrup	℥ ij
Water, ad.	oj

M Sig.—A tablespoonful four times a day.

The tonic effects are admirable, and the general condition greatly improved.

GOA POWDER.

(Andira Araroba.)

So much has lately been said concerning the advisability of administering internally the active principle of this drug, viz., Chrysophanic acid, that I think it will interest my readers to have particulars as to the success obtained by this method.

Mr. Alexander Napier, M.D., Assistant to the Professor of Materia Medica and Therapeutics, Glasgow University; Physician for Skin Diseases, Anderson's College Dispensary, in the *Lancet*, May 20th, 1882, p. 817, gives particulars as to the internal administration of Chrysophanic acid, from which I extract the following :—

I fancy that very few will be inclined at the present time to dispute the statement that of all the remedies which are at our disposal for the treatment of psoriasis, chrysophanic acid applied externally is the best and the most generally serviceable. This, however, is a mode of treatment which has many drawbacks. It is excessively dirty, and this is the more disagreeable and troublesome the more extensive the surface to be treated. To a tender or delicate skin the acid proves extremely irritating, even when used in the form of a weak ointment, necessitating frequent pauses in treatment, to allow the irritation to subside. It stains the hands and nails, and the normal integument generally, of a dingy, greenish-brown colour, and it dyes such hair as is light in colour: the hair, originally white, of a patient whose case is well described by Dr. James Adams (*Edinburgh Medical Journal*, July, 1878), "rapidly assuming a bright canary colour, ending in a fine purple." It soils under-clothing, linen, &c., the stains it produces being removable only by the prolonged use of bleaching powder, or by hot benzole, provided no soap or alkali has been used. And, lastly, the quantity of the drug needed to effect a cure, if applied externally and as freely as it should be, is very considerable, and the cost of it places it beyond the reach of the poor or of patients treated gratuitously; thus Professor Charteris speaks of having used thirty-two ounces of ointment (one drachm to one ounce of lard) in one case, and in twenty-four applications.

About a year ago, when considering how these disadvantages might be minimised, the use of the remedy by internal administration very naturally suggested itself. That chrysophanic acid has a constitutional, as well as a local, action, seemed pretty evident from some cases which were treated in the winter of 1880-81 in Professor Charteris' Wards in the Glasgow Royal Infirmary, and recorded by him in the *Lancet* of April 23rd, 1881. The indications of constitutional action in these and some other cases which he treated in the same way (by the external use of the acid) were the occassional production of nausea, vomiting, looseness of the bowels, and, principally, the fact that cases treated by the application of the ointment to one side of the body only were cured, the eruption disappearing nearly as rapidly from one side as from the other. I saw one of the patients so treated, and am able to testify that the cure was equally thorough on both sides. Several patients of my own had also stated spontaneously that their hair, formerly light, had become perceptibly darker, though none of the acid had been applied to the scalp. This I set down at the time to the accidental contact of the remedy with the hair. It will be seen from the following cases, however, that the drug may be administered in small doses with perfect safety and with a certain measure of success :—

CASE 1.—D. A——, aged sixteen, a strong, healthy-looking lad, appeared at Anderson's College Dispensary on September 28th, 1881, suffering from ordinary diffused psoriasis. He had never had any kind of eruption on the skin before. Early in the previous July he had been attacked by British cholera, and as he gradually recovered from that the present eruption was noticed, first on the extensor surfaces of the knees and elbows simultaneously, and thence spreading over the whole body. On the date above-named the patient was put on arsenical treatment. This apparently had no very good effect, for on November 2nd the following note was taken :—"The eruption is a typical psoriasis, and is found on limbs and trunk, being specially abundant on the back; face, palms, and soles free from eruption; scalp very extensively and severely involved. Of late the eruption has been itchy at night. The following was prescribed: three grains of chrysophanic acid and forty grains of sugar of milk, to be made into twenty-four powders, one powder to be taken after each meal. November 9th: Patches much paler, less scaly, and very much less itchy. Ordered four grains of the acid in twenty-four powders, to be taken as before. No vomiting or any sign of gastro-intestinal disturbance.—23rd: Patches still paler and less itchy. Ordered six grains in twenty-four powders.—30th: Eight grains in twenty-four powders.—Dec. 7th: Ten grains in twenty-four powders.—21st: Improvement very marked. Ordered twelve grains in twenty-four powders. 28th: Sixteen grains in twenty-four powders. Still no irritation of stomach or bowels; no pain, vomiting, or diarrhœa.—January 4th, 1882: Nearly well. Twenty-four grains in twenty-four powders.—18th: Thirty-six grains in twenty-four powders.—25th: Forty-eight grains in twenty-four powders.—February 2nd: Patient is now perfectly well; there is no trace of the eruption on body or head; on the elbows and knees the skin on the sites of the patches is slightly paler than healthy skin, but beyond this there is now no indication that there has been any eruption on these parts. Patient states that improvement was earliest and most evident on the scalp. Up to this point there has been no sign of irritation of stomach or bowels. As a precautionary measure, to prevent relapse, powders containing seventy-two grains of the acid in twenty-four—that is, a dose of three grains in each—were prescribed.—15th: Last powders caused vomiting, and occasionally pain in stomach and bowels. Ordered sixty grains in twenty-four powders—i.e., a dose of two grains and a half in each. 22nd: Last powders also caused vomiting, but without pain or any other discomfort. Ordered a pill containing one grain of chrysophanic acid and one grain of extract of hyoscyamus.—March 1st: The pills also made patient sick directly after they were taken. Ordered one-grain doses in sugar of milk.—8th: These powders still cause sickness, but only occasionally. Ordered half-grain doses.—April 4th: Skin still clear of eruption; only faint pale mark showing the site of the patches on elbows and knees. These marks seem paler than usual against the neighbouring healthy skin. The powders last prescribed (half-grain dose of the acid) have caused no vomiting or other discomfort. During the course of treatment the patient has had no conjunctivitis, and has not noticed any change in the colour of his hair. The medicine very seldom caused pain in the stomach or bowels. Vomiting, when it did eventually come on, was easy and painless. There was no interference with appetite or digestive power; only occasionally were the bowels caused to act rather freely. The urine had frequently "a very heavy smell" and looked "muddy," but showed no very decided change in colour. The course of treatment in this case was somewhat prolonged, but it must be borne in mind that much time was lost at first by the employment of such small doses, through fear of the remedy.

Case 2.—T. A——, brother of the preceding, a strong-looking boy of twelve years of age, presented himself at the dispensary on January 4th, 1882, suffering from well-marked psoriasis. The eruption was not so extensive as in the preceding case, and was found chiefly on the extensor surfaces of the arms and legs. Ordered one-third of a grain of chrysophanic acid, rubbed up with sugar of milk, after each meal.—January 18th: Little if any improvement; to have half a grain of the acid after each meal.—February 15th: Since the last note the dose has been gradually increased, till latterly he has been taking one grain and a half after each meal. This, however, has lately caused vomiting several times. Dose reduced to half a grain in pill, with extract of hyoscyamus.—March 1st: Pills also make the patient sick. Ordered quarter of a grain in powder.—8th: Eruption improving. To continue acid in quarter of a grain doses.—April 5th: Eruption very much better; patches pale and less scaly; continue quarter of a grain doses of the acid.

These two cases were shown at a meeting of the Glasgow Medico-Chirurgical Society, on April 7th, 1882.

CASE 3.—Mrs. H——, aged thirty-seven, presented herself at Anderson's College Dispensary on November 16th, 1881, suffering from an eruption which had appeared several years in succession, beginning usually in spring. The present attack began two months ago. The eruption consists of well-marked patches of psoriasis, the largest of which are situated on the elbows and knees, many of them being as large as a shilling piece. Over the back and chest the spots are smaller, about as large as a split pea. To have a quarter of a grain of chrysophanic acid, with a few grains of sugar of milk, after each meal.—November 21st: The patches were much paler, the scales separating freely. As the acid had not caused pain, or vomiting, or any discomfort, the dose was increased to one third of a grain. As this patient did not return her further history is unknown to me.

Several other cases of psoriasis have been treated with chrysophanic acid internally by me; but of these I can give no very satisfactory report, mainly on account of the irregularity of attendance and carelessness in following instructions, so characteristic of many of the poorest classes, who form the bulk of our dispensary patients.

The foregoing embodies practically the whole of my experience of the use of chrysophanic acid by internal administration. Of course it would be presumptuous to dogmatise on the strength of this, but I think I have shown, for the first time, that in certain cases psoriasis may be cured by the use of chrysophanic acid in this way, that the belief that the remedy has a general as well as a local action on the system is well founded, and that this drug is capable of being absorbed when taken internally, and of exercising a special influence on the skin after absorption. Treatment by chrysophanic acid used in this fashion appears somewhat slow, yet there must be many cases in which this mode of treatment will prove the best; as, for instance, when the eruption is very extensive, when the skin is very delicate and irritable, and when expense is an obstacle to the use of the drug in any other way. It seems to me that the dose should at first be small. I would suggest half a grain as a good medium dose for an adult to start with. The dose should be increased gradually, as the stomach is found able to bear it. It would appear, however, from Case 1, that if once intolerance of the drug be set up, doses which were previously well borne cause vomiting and other signs of gastro-intestinal irritation, and small doses must again be resorted to. The drug seems also to be better sustained when given in powder, after food, and combined simply with sugar of milk; the pill containing extract of hyoscyamus with chrysophanic acid seemed to cause most irritation.

The employment of chrysophanic acid internally in medicine is no new thing. Dr. J. Ashburton Thompson, who experimented with it in over 300 cases, describes it as a valuable new emetic purge, having an action on the liver, and recommends an average dose of six grains for a child of ten, and ten to fifteen grains for an adult. He says that it leads to the evacuation of large quantities of bile, and he has used it with success in hepatic obstruction—congestive, catarrhal, and the like. He thinks it "a useful addition to our list of remedies, because it affords the means of clearing out the primæ viæ with a thoroughness and promptitude not equalled by any

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other remedy with which he is acquainted, a combination of ipecacuanha and tartar emetic alone excepted."

At p. 460 of Wood's "Therapeutics," 1881, Schlossberger, Bucheim, Meykow, and v. Auer are quoted as authorities for the statement that chrysophanic is not a purgative, while it is stated that Schroff has found that it has a purgative action. And in vol. i. of Dr. C. D. F. Phillips' "Materia Medica and Therapeutics," 1874, p. 182 *et seq.*, reference is made to the views of Nothnagel and T. and A. Husemann as to the purgative action of chrysophanic acid. All this, however, is very different from the use of the drug I have been discussing, and from the effects it produces in continued small doses.

NOTE.– Since the above was written, Professor Charteris has had a case of psoriasis in his wards in the Royal Infirmary under treatment by chrysophanic acid internally. The patient is a girl thirteen years of age, and this is her first attack of the disease. The eruption was very extensively distributed, no region of the body being free from it. Treatment was begun by the administration of chrysophanic acid in half-grain doses three times a day made into pills with crumb of bread; the dose has been gradually increased, till now the patient takes nine grains daily in separate doses of one grain. At first there was occasionally slight sickness, but now complete toleration of the medicine is established; there is no sickness or vomiting, no pain in the stomach, and appetite and digestion are unaffected. The influence of the remedy on the eruption is most striking after about six weeks' treatment; most of the patches on the trunk have quite disappeared, while those on the limbs are healing very rapidly, especially in the centre. The nurse in charge of the case very aptly remarked that this was a much pleasanter way of using the acid.

After reading this, I sent to Dr. Napier some especially prepared Chrysophanic Acid, which I am sure will give better results.

JABORANDI.

(Pilocarpus pennatifolius.)

Owing to the very successful results obtained with this drug in cases requiring a sialogogue or diaphoretic treatment, and lately in that terrible disease, Hydrophobia, there has naturally sprung up a large demand for the active principle of the leaves of this plant, *i.e.*, Pilocarpine. I have lately been distributing the seed of the Pilocarpus, and am now expecting a fresh supply over, so that planters who care to do so, can give this plant a trial.

I think it will interest my readers, if I give them the report of a case of Hydrophobia cured by Pilocarpine.

The following has been translated from *La Petite République Française*, June 16th, 1882:—

"It was not without a certain emotion that the Academy of Medicine and the public listened on the 13th June to a communication read to the Medical Institute of Paris by Dr. Denis Dumont, who came expressly from Caen for that purpose.

"A mad dog towards the middle of April bit three persons at Feuguerolles (Calvados), a woman, a shepherd, and a little girl. The shepherd cauterised his wound with a solution of nitrate of silver. The wound healed and apparently all was well. Nothing occurred to trouble the usual health of the man until on the 20th May, thirty-six days after the accident, he heard of the death of his wife, who was bitten at the same time and by the same dog as himself. He then became nervous, and fever set in.

"Grillé (the name of the Normandy shepherd) could not sleep during the night of 21st to 22nd; he suffered from a burning thirst, with contraction of the throat. He left home at early morn and wandered across the country, entered friends' houses and cafés, trying, but in vain, to quench his thirst. He felt the greatest difficulty in swallowing any liquid whatever, no sooner did he take a cup of cider than he rejected it violently. He said he felt a painful and insupportable weight at the epigastrium; on the front of the left arm, where he had been bitten, a violent itching declared itself, which soon became a real torture. At last the crisis arrived; he was seen to leave the café suddenly, where he had been seated, to throw himself prostrate in the middle of the road, rolling about, biting at stones, at the sticks they presented to him, and finally biting himself. He uttered wild shrieks, warning people not to approach him, otherwise he would not be able to refrain from biting them.

"The crowd about him secured him, he became pacified, the next day he was admitted to the hospital (Hotel Dieu) at Caen.

"Here is the result of the examination made:—The patient complained of acute pains in the epigastrium, precordial anxiety, he despaired of recovery and begged to be killed; deglutition was next to impossible. He was a prey to characteristic crisis, his head was thrown back, his breathing became laborious, his jaws in continual motion, his teeth chattering, his arms became stiff, his legs shook with convulsive starts, his face was scarlet, the pupil dilated, the patient perspired copiously, he was unconscious, but as soon as the crisis was passed he regained consciousness; he uttered hoarse cries analogous to the bark of a dog. That hoarseness of the voice is a very characteristic symptom. A detail of interest was to note the re-opening of the cicatrised wound resulting from the bite of the dog; it was of a palish red, from which issued a viscuous serosity, and presented a livid aspect quite peculiar, being surrounded by a purple zone.

"Dr. Denis Dumont prescribed Bromine of Potassium with syrup of Codéine; but he obtained no relief, the fits came on again with more violence, the contraction of the larynx became stronger, deglutition was impossible.

"It was at this period that Dr. Denis Dumont had the happy idea to encourage the sweatings and salivation of the patient. By doing this, he was favouring an indication of nature; he considered these phenomena as efforts made by our organisation to throw off the rabid poison. Could not a powerful means be found to excite the medicinal activity of the buccal and sudorific glands?

"*Nitrate of Pilocarpine* offers this means. Three sub-cutaneous injections of 1 centigramme of Pilocarpine each were given in the interval of a day. An effect was immediately produced—profuse sweatings and intense salivation re-appeared. This treatment was continued for four or five days. During this interval the fits became weaker, less frequent, and at last ceased altogether. Grillé was cured.

"The little girl who was bitten by the same dog has felt no effects up to this day. We ask ourselves this question—'Is not this an indication which permits us to admit that there are degrees of rabid intoxication, and that therefore the remedy which may be triumphant in one case may fail in another?'

"Mr. Bouley, who asked to speak at the next meeting, proposes to submit a report of a case of rabies treated and cured by Nitrate of Pilocarpine.

"Mr. Dartigues de Pujol (Gironde) was the successful practitioner."

In support of the use of Pilocarpine in eliminating from the human system specific poisons, I will now give my readers an extract of a case of typhoid fever successfully treated with this drug by RICHARD RYDER, M.D., L.R.C.P. Ed., L.R.C.S.I., reported in the *Medical Press and Circular*, and I may here state that I entirely agree with Dr. Ryder's remarks, as I know several medical men who have tried the effect of Pilocarpine with so much success that they are now recommending it largely in such cases.

Dr. Ryder says:—

In the *British Medical Journal* of the 6th of May last I published a short report of the success attending sudorific treatment in the early stages of typhoid fever, and since then I have had further opportunities of testing the efficacy of this plan of treatment by the administration of jaborandi, which I believe to be one of the most valuable remedies we possess in the early stages, not only in febrile, but in acute and inflammatory affections, whether arising from cold, blood poisoning, or other causes.

I believe jaborandi to possess the power of eliminating from the human system almost any specific poison, by means of the skin, if resorted to at once, and before that poison has had time to set up its peculiar action.

I saw a lady who had been suddenly taken ill with all the premonitory symptoms of typhoid, and as she had suffered but a short time before from that disease, she was convinced in her own mind of the nature of the attack, and on being questioned said: "I feel exactly as I did when I was sickening for typhoid fever."

I immediately resorted to active sudorific treatment, assisted by numerous blankets, covering all with a mackintosh sheet to prevent the least evaporation. I then kept up the action of the skin till all the abnormal symptoms had subsided. In less than ten hours from the time of commencing the treatment the patient was convalescent, only complaining of weakness. That is more than twelve years ago, and since then I believe I have been the means of arresting a very large number of similar cases.

The introduction, therefore, of jaborandi as a therapeutic agent was hailed by me as one of the most valuable additions to our materia medica. I look on it in the early stages of fever in the same light as salicylate of soda in acute rheumatism. I have found it reduce the temperature to its normal standard within a few hours, removing at the same time all abnormal symptoms.

The sweating usually commences in from three to five minutes if the dose is sufficiently large and the preparation a reliable one. If there is no action of the skin from the first dose within the hour, I repeat it, giving double the quantity for the next. In conclusion, I must say that I have the most implicit confidence in this plan of treatment, and believe that jaborandi will effectually stop an attack of fever if taken in its first stage. But it frequently occurs that the medical man does not see the case till it is too far advanced to derive benefit from it.

COCA.

(*Erythroxylon Coca.*)

The following interesting particulars concerning this drug have appeared in the *Produce Markets Review*, and are extracted from Mr. Markham's excellent book, " Peruvian Barks." It will be seen, as I pointed out in former numbers of this series, that the Indians reject as useless leaves over seven months old, for they then lose not only their agreeable aroma, but also the invigorating properties for which this plant is so much esteemed.

The Coca is the greatest source of comfort and enjoyment to the Peruvian Indian. It is to him what the kava-kava is to the South Sea Islander, the betel to the Hindu and Malay, and tobacco to the rest of mankind, but with this difference, it produces invigorating effects. The Peruvian Indian looks upon Coca with veneration. In the palmy days of the Uncas or Yncas, Coca was sacrificed to the sun, the high priests or Huillac Umu chewed it during the ceremony, and before the arrival of the Spaniards, Coca was used in lieu of money. After the Spanish Conquest much was done to proscribe its uses, because, as a Council of Bishops held in 1569 said, it was a " useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians, that the habit of chewing Coca gave them strength, which is an illusion of the devil." Coca, indeed, from its popularity, being used by about eight millions of people, has always had a great commercial importance, and one Viceroy, Don Francisco Toledo, issued no less than seventy ordinances concerning Coca in the space of four years (1570—1574).

The seeds of the Coca are sown on the surface of the soil as soon as the rainy season commences, and begin to sprout in a fortnight, being carefully watered, and protected from the sun by a thatched roof. The following year the seedlings are transplanted in a soil carefully broken up and freed from weeds. The ancient custom was to raise the plants in terraces on the hill sides, but now plantations on the level ground are resorted to, although Indians aver that plants raised under the former conditions yield a much superior quality of leaf. At the end of eighteen months the first harvest is ready, and the picking of the leaves, performed by women and children, is very carefully proceeded with, so as not to injure the young and still tender shoots. As soon as one crop of leaves is removed, if well watered, and the ground carefully weeded, another crop is ready in about forty days. A plant continues to yield for about forty years, and Dr. Poeppig gives the profit of a Coca plantation as about 45 per cent. Each picker carries a piece of cloth, in which the leaves, plucked one by one, are placed. These leaves are then taken to the drying-yard, formed of slate flags. Here the leaves are spread out in thin layers, and carefully dried in the sun. Too much exposure to the sun spoils the flavour of the leaf, and if heaped too much together, the leaves ferment and become fœtid. As soon as dried, the leaves are packed in bags made of banana leaves, with an outside covering of cloth, or packed tightly in large parcels of about 50 lbs. each. In the Sandia district of Caravaya two varieties of Coca are recognised, the Ypara and the Hatun Yunca, the latter having a larger leaf than the former. In Bolivia, Coca is treated as a Government monopoly, and the right is generally farmed out. In 1850, Coca brought into that country's exchequer a sum of 200,000 dollars. The whole yield of Coca in South America is estimated at thirty millions of pounds. Coca soon deteriorates in keeping, and Indians treat it as valueless if kept longer than seven months. Such is the faith in Coca, that it is believed if a dying man can but taste a Coca leaf when placed on his tongue, his future bliss is assured. No Indian is without his *cuspa* or Coca bag, made of llama cloth, and three times a day, sitting down, he takes leaf by leaf and rolls them up in his mouth till he forms a ball. Then applying a small quantity of powder, consisting of carbonate of potash, made by burning the stalks of the quinoa plant, mixed with lime and water, he goes on his way rejoicing. The use of Coca is widely spread. The shepherd on the cold slopes of the Andes has but this and a little maize as his sole nourishment, and the runner messenger looks to it as his solace and support.

I have coming over 2000 lbs. weight of the fresh leaves, to test if there is any deterioration in the properties through the journey, I have some of the plants growing at Sydenham, which I can supply to any who wish to experiment with them in the Colonies.

LIST OF THOS. CHRISTY & CO.'S

NEW IMPORTATIONS OF

DRUGS AND REMEDIES.

AFRICAN PEACH ROOT.—A fine bitter tonic, extensively used for indigestion, &c., on the West Coast of Africa.

AJOWAN SEEDS (*Ptychotis Ajowan*) have obtained considerable repute in India as a remedy for flatulence, colic, atonic dyspepsia and diarrhœa, as well as for cholera. They are found to contain the antiseptic properties of Thymol, and owing to their containing this substance in small quantities in a natural state, they are considered safer and better fitted for internal administration to children than Thymol. ("New Commercial Plants," No. IV. p. 47.)

The oil, diluted with soap liniment, or any bland oil, is said to prove valuable as a stimulant embrocation in chronic rheumatism. Mr. Wood, upon the authority of Mr. H. H. Lynsdale, considers the proportion of the seed ordinarily used in preparing the distilled water to be too small; the latter advises 3 lbs. of the bruised seeds to six quart bottles of water, and four quarts to be distilled over.

Preparation: Oil of Ajowan.

Doses: From 1 to 3 drops, on sugar or in emulsion.

To children the seeds may be given in the form of comfits or other sweetmeats.

ALSTONIA CONSTRICTA, or Queensland Fever Bark, has been found to contain some important alkaloids, one of which—Alstonidine—is said by Dr. O. Hesse to combine properties similar to those of Quinine and Nux-Vomica. This opinion has been confirmed by Dr. Bixby, who met with considerable success with this drug in the treatment of cases of typhoid, synochal and puerperal fevers, coryza, &c. (For further particulars see "New Commercial Plants and Drugs," No. IV., p. 30.)

The tincture may be made with 2 ozs. of the bark to a pint of proof spirit, and the fluid extract according to the process given in the *United States Pharmacopœia* for other fluid extracts.

Preparations: Powdered bark (given in syrup or glycerine), and the tincture and fluid extracts.

Doses: In coryza, the powdered bark in 2-grain doses every two hours. The dose is usually from ½ to 2 grains every one to four hours, and in inveterate cases as much as 6-grain doses have produced good results. If the dose be too large, headache with nervousness will be produced. The tincture and fluid extract may be given in amount equal to the dose of bark.

ANDROGRAPHIS KARIYAT (*Andrographis paniculata*).—A valuable drug, official in the *Indian Pharmacopœia* as a tonic and stimulant. It is used in several forms of dyspepsia, especially when accompanied by constipation. Roxburgh mentions that its Indian name, *Maha tita*, signifies "king of bitters," and adds:—"and a very powerful and much esteemed one it is."

Preparation: Compound infusion (herb bruised, ½ oz.; orange peel and coriander fruit, bruised, of each 60 grains; boiling water, 10 fluid ozs. Infuse in a covered vessel for an hour, and strain).

Doses: 1½ fluid ozs. to 2 ozs. twice or three times a day.

ATEES (*Aconitum heterophyllum*).—The root of this drug is, owing to its tonic and antiperiodic properties, and also to the absence of aconitia or poisonous principle, of great value in convalescence after debilitating diseases, as well as in intermittent and other paroxysmal fevers (see *Indian Pharmacopœia*, p. 4.)

Preparation: Powdered root.

Doses: As a tonic, 5 to 10 grains three times a day; as an antiperiodic, 20 to 30 grains every three or four hours, irrespective of the presence of pyrexia.

ATHEROSPERMA MOSCHATA (Australian Sassafras) is used as a diaphoretic and diuretic in asthma and other pulmonary affections, and in the Australian hospitals, in some forms of heart disease (see "New Commercial Plants and Drugs," No. IV., p. 46.)

Preparations: Tincture and essential oil.

Doses: Of the oil 1 to 3 drops every six or eight hours. Of the tincture (2 ozs. of bark to the pint of rectified spirit) 30 to 60 drops.

AUSTRALIAN PEPPER (*Piper Novæ-Hollandiæ*).—A powerful stimulant tonic to the mucous membrane, used by Dr. Bancroft in the treatment of gonorrhœa and other mucous discharges with considerable success.

This remedy has not yet been tried in this country. It may be given in the same way as Kava-Kava.

AZADIRACHTA BARK.—This drug has been successful in cases of intermittent and other paroxysmal fevers, in general debility, and convalescence after febrile and other diseases (*Indian Pharmacopœia*, p. 53).

Preparation: The decoction (2 ozs. of the inner layer of the bark, bruised, to a pint and a half of water; boil for fifteen minutes, and strain whilst hot). As the decoction decomposes in hot weather, it should be prepared fresh when wanted.

The tincture (inner layer of bark, bruised, 2½ ozs., and proof spirit, 1 pint). For method of preparing this tincture see *Indian Pharmacopœia*, p. 54.

Doses: Of the decoction, as an antiperiodic, 1½ to 3 fluid ozs. every second hour previous to an expected paroxysm.

As a tonic,   to 2 fluid ozs. twice or thrice daily.

Of the tincture, ½ to 2 fluid drachms as a tonic.

BAI-MO (*Fritillaria Thunbergii*).—Used in Japan and China for rheumatism and aching joints, and said to be a cure for an ulcer called Nin-meucho. ("New Commercial Plants and Drugs," No. IV., p. 49.)

This drug not having been tried here, we are unable to give its preparations and doses.

BAUCHEE SEEDS (*Psoralea corylifolia*) are now being tried in England for scaly eruptions of the skin, especially leucoderma and leprosy (see "New Commercial Plants and Drugs," No. IV., p. 47.)

Combined with Chaulmugra oil, this drug has proved very successful in bad cases of leprosy.

The oil expressed from these seeds is stated by Dr. Dymock to have been a good deal used in Bombay, with, it is said, very favourable results.

BELLADONNA ROOT, Japanese (*Scopolia Japonica*). Dr. A. Langgaard (see "New Remedies," June, 1880) extracted two alkaloids from this root, one of which he called "Rotoïne;" a few drops of the aqueous solution of the sulphate of this alkaloid being dropped into the eye of a rabbit produced dilatation. The second alkaloid he called "Scopoleïne," which, he says, seems to act like atropine. Whether it be identical or not with that alkaloid has yet to be proved.

Dr. G. Martin, of Tokio, Japan, states that it contains solanine, but no atropine.

In Japan this root is used for the same purpose as Belladonna is in this country, and preparations might be made of it of similar strength to those in the *British Pharmacopœia*, for experimental purposes.

BOLDO LEAVES (*Peumus Boldus*).—This is a South American drug, which has been successfully employed in France in cases of atony of various organs, when quinine could not be tolerated, or when there existed chronic hepatic torpor. It seems especially beneficial in the treatment of rheumatism, gonorrhœa and dyspepsia, and its use is favorably spoken of in chronic catarrh of the bladder. The Boldo being balsamic and carminative, it is an important auxiliary in the treatment of hepatic abscesses whenever the febrile symptoms have been overcome.

This drug is said to cure the fluke in sheep which have eaten of the leaves. (*New Remedies*, March, 1879, p. 66.)

Preparations and their Doses: Fluid extract, 1 to 5 drops, to be increased.
Tincture, 4 ozs. leaves to 20 ozs. alcohol. Dose, 10 to 20 drops three times a day.
Wine, three parts of the leaves to 100 of Madeira wine. Dose, a dessertspoonful.
Leaves, 8 to 16 grains; over 30 grains produces vomiting in human beings.

BONDUC SEEDS (*Cæsalpinia Bonducella*).—The seeds possess tonic and antiperiodic properties, and are said in some cases to have cured as promptly as quinine. Mixed with castor oil they are applied externally in hydrocele (see "New Commercial Plants and Drugs," No. IV., p. 48.)

Preparations: Compound powder of Bonduc (Bonduc and Black Pepper, *Indian Pharm.*, p. 68-9) and the seeds.

Doses: Powder, 15 to 30 grains, three times a day.
Seeds, 10 to 15 grains, twice daily.

CALABAR BEANS (*Physostigma venenosum*). — Eserine, the active principle of these beans has of late been very largely used for contracting the pupil of the eye.

Preparations: The sulphate, pure, nitrate, tartras, and salicylate of Eserine.

Of the sulphate the solution is sometimes made of the strength of 4 grains to the ounce of water, for dropping into the eye.

CARNAUBA ROOT (*Corypha cerifera*).—This root possesses valuable diuretic properties, and has been introduced into England as a substitute for sarsaparilla (see "New Commercial Plants and Drugs," No. VI.)

Preparations: The decoction is made by boiling 1 oz. in 1½ pints of water down to 1 pint, and the fluid extract is made so that 1 oz. shall represent 1 oz. of the drug.

Doses: Of the decoction, 1 oz.; of the fluid extract, 1 drachm, diluted with water.

CAROBA LEAVES (*Jacaranda tomentosa*). — This drug possesses great alterative diuretic, and sudorific properties, and is considered an excellent tonic. Dr. O. Alt found it most successful in all forms of syphilis, and more especially in old syphilitic eruptions (see "New Commercial Plants," No. IV. and V.)

Preparation: Fluid extract of the leaves, made so that 1 drachm represents 1 oz. of the leaves.

Doses: ½ to 1 fluid drachm, according to cases, three times a day; or a decoction of 2 drachms of the leaves may be taken during the day.

CHAULMUGRA OIL (*Oleum Gynocardiæ*), for rheumatism, rheumatic gout, psoriasis, phthisis and various skin diseases (see "New Commercial Plants and Drugs," Nos. II., III. and IV.)

It has been found by hunting men one of the most useful things in a stable, in case of accident to man or horse.

Mr. Wm. Murrell, M.D., F.R.C.P. (Senior Assistant-Physician to the Royal Hospital for Diseases of the Chest, Lecturer on Practical Physiology at the Westminster Hospital), in his report to the *British Medical Journal*, November 27th, 1880, speaks very highly of this oil in Phthisis, the patients taking the Chaulmugra with benefit, after they had ceased to improve on Cod-liver oil.

H. Nelson Hardy, F R.C.S., late Surgeon City of London and East London Dispensary, tried Chaulmugra successfully in some obstinate cases of Psoriasis.

John D. Hillis, F.R.C.S.I., M.K.Q.C.P., Medical Superintendent of the General Leper Asylum of British Guiana, West Indies, writes to *The Therapeutic Gazette*:—

> I have read with interest the article in the Journal of March 26th, on Chaulmugra Oil in Leprosy. I have also tried, and with much success, Chaulmugra Oil in true leprosy. I give it internally, in doses commencing with ten minims in emulsion with milk; and externally I apply a liniment of one part of Chaulmugra Oil to fifteen of olive oil to the eruption, the diseased nerves, or the tubercular surfaces. In private practice, I use the capsules, which my patients take without difficulty. Contrary to Dr. Murrell's experience, I find that the oil causes constipation, and, in consequence, I am in the habit of administering it with castor oil.
>
> I enclose a copy of my last official report, which shows the results of the treatment

in some cases in which this remedy was tried. In another, all traces of the disease disappeared, and had not returned at the expiration of two years.

David Young, M.D., Florence, in an article in the *Practitioner*, gives his experience with Chaulmugra Oil, and recommends "the internal administration of doses varying from 5 to 20 drops three times a day. Externally, a liniment of an oz. of Chaulmugra Oil and a drachm of rectified spirit was applied to the diseased surface. A seed known as Psoralea, held in repute, was in some instances employed in conjunction with the oil."

Dr. J. H. Egan, in his report to the *Chicago Medical Review*, on Chaulmugra in the treatment of Sciatica, says:—

> I have in a number of cases tested the value of Chaulmugra Oil in sciatica, and not knowing of its previous employment in this affection, I submit the following report:—
>
> Case 1.—Sciatica of four years' standing had resisted all of the usual remedies, and yet continued unrelieved. The pain at night destroyed sleep. The free use of the oil, with friction, upon retiring, was followed on the first trial by so much relief that sleep followed. The same relief was experienced on subsequent nights during the short time the patient was under my observation. Unfortunately I soon lost sight of the patient, and cannot now give the final result.
>
> Case 2.—Elated by the temporary success in the first case, I tried the same remedy in the case of the next patient who came suffering from sciatica. This was a lady thirty-five years of age, married and the mother of two children. The hypodermic administration of morphia had been employed to such an extent that the patient now refused further medication of this kind. Vesicants and the galvanic battery had been of no avail. After a week's use of the oil she became able to walk without crutches, and is now well.
>
> In addition to the above, I have since treated six cases of sciatica with the same remedy and with the same results.

Sir Joseph Fayrer and Surgeon-Major Balfour both speak highly of it.

In the *Lancet*, June 18th, 1881, p. 987, Mr. W. Alexander, M.D., F.R.C.S., reports a case of *Elephantiasis Græcorum*, relieved by the administration of Chaulmugra Oil.

See also report of Dr. Wyndham Cottle, M.A., M.B., F.R.C.S., in *British Medical Journal*, June 25th, 1881, p. 999, on successful treatment of Leprosy, Psoriasis, Eczema, Lichen planus, Lupus, &c., by Chaulmugra Oil and Gynocardic Acid. (For extract from this report see p. 8 of this list).

Preparations: Oil, capsules, and Gynocardic acid.

Doses: Oil in Capsules, 3 to 10 minims, taken after meals.

CHIAN TURPENTINE *(Pistacia Terebinthus)*, the new remedy for cancer, introduced by Prof. Clay, who has used it most successfully in cases of uterine cancer (see "New Commercial Plants and Drugs," No. IV., p. 40.)

Preparations: Pills (Tereb. Chio. gr. 3, Flor. Sulphuris, gr. 2).

Dose: One every four hours.

COCA (*Erythroxylon Coca*).—The parts used are the leaves, the extract from the green leaves, and the elixir. This drug, taken in small doses, produces a gentle excitant effect, and is used by the natives of Brazil to relieve fatigue, and as a nerve stimulant. Cocaine, the active principle of Coca, dilates the pupil of the eye. The preparations made from the green leaves are much superior to those obtained from the dried leaves, as imported into this country. The tincture in typhoid fever, acute and chronic pneumonic phthisis, has been found most useful. It lessens fatigue and increases the respiratory powers and is a cure for the opium habit (see "New Commercial Plants and Drugs," Nos. III. & IV. and V.)

Preparations: Extract from green leaves, elixirs, tincture and wine.

The wine is made thus: Coca leaves 30 parts, alcohol (60°) 60 parts; macerate 24 hours and add white wine 1000 parts; macerate 10 hours longer and strain.

Doses—		
	Solid extract	6 to 12 grains
	Fluid extract	20 to 30 minims
	Elixir	1 to 2 fluid ounces
	Tincture	1 to 2 fluid drachms

COLA NUTS (*Sterculia acuminata*) contain a considerable quantity of theïne as well as theobromine, and are esteemed as a valuable restorative and tonic in indigestion. These nuts are chewed, a small portion of the powder being placed on the tongue occasionally.

It is worthy of a trial in lieu of Guarana for sick headache, as that drug occasionally produces disagreeable symptoms; also for liver disease and indigestion (see "New Commercial Plants," Nos. III and VI).

CURARE (*Strychnos toxifera, &c.*)—Used for epilepsy and chorea, and recommended for hydrophobia (see *Pharmaceutical Journal*, 3rd series, vol. 8, p. 421; *British Medical Journal*, 1878, part I., p. 857.) The present stock is of excellent quality, half the ordinary dose having been found sufficient in experiments made in Paris.

Preparation: Hypodermic injection, made by dissolving 1 grain of Curare in 12 minims of water.

DAMIANA (*Turnera aphrodisiaca*) is used in renal and vesical diseases, nephritic albuminuria, diabetes, and has proved successful as a nervine tonic in a case of blindness from tobacco amaurosis; also as a tonic for the genito-urinary tract (see "New Commercial Plants and Drugs," No. IV., p. 31).

Preparations: Fluid extract, tea, and infusion.

Infusion: 2 ozs. of the leaves, and ¾-oz. of liquorice root to 16 ozs. boiling water, macerated for eight hours.

Doses: Fluid extract, ½ to 2 fluid drachms three times a day.
Solid extract, 3 to 6 grains.
Tincture, ½ to 2 drachms (2 ozs. of the drug to 1 pint of proof spirit).
Infusion: 2 to 4 ounces.

A good deal of spurious Damiana (*Aplopappus discoideus*) is sold for the true drug.

DOLICHOS SINENSIS (*Soy Beans*).—These beans are eaten by the Chinese after they have been made into a curd. They are, however, mainly used to manufacture an edible oil, and the refuse pulp is then pressed into cakes, weighing about 60 pounds, which are used either as fodder for animals, or more frequently as manure, especially for the sugar cane. The Soy Bean is cultivated in Asia for preparing from the seeds the well-known sauce called "Soy." We have just received a supply of these beans, which we are offering at a moderate price.

DUBOISIA (*Duboisia myoporoides*) has been successfully used in various forms of ophthalmic diseases, and Dr. Dujardin-Beaumetz substituted it for atropine in ex-ophthalmic goitre (see "New Commercial Plants and Drugs," No. IV., p. 40.)

Dr. Sydney Ringer, in the *Practitioner*, October 18th, 1879, in an article on the relative action of Duboisia and Atropia, says :—" Duboisia, we find, produces identically the same symptoms as Atropia, but is far more powerful than Atropia."

Preparations : Solid extract, Duboisine, and sulphate of Duboisine.

Doses : Solid extract, 10 grains to the ounce of water, as an hypodermic injection.
Duboisine, ½ grain to the ounce of water.

EUPHORBIA PILULIFERA, *L.*— This new drug, has proved most successful in cases of asthma, bronchitis, coughs, influenza, affections of the chest, and is now being tried for hay-fever. The results obtained are published in "New Commercial Plants and Drugs," No. V, p. 64.

Preparations.—As this plant is a poison, great care should be taken not to make too strong a decoction, or ill instead of good results may be expected. The decoction is prepared as follows: Place an ounce of the weed in an enamelled saucepan containing two quarts of cold water, boil, and then allow it to simmer for a couple of hours, or until the quantity of water is reduced to one quart; strain it, allow it to cool, and bottle for use, adding a teaspoonful of spirit to fortify and prevent fermentation ; also a concentrated essence.

Doses : Decoction, 2 fluid ounces to be taken at night before going to bed, on rising in the morning, and an hour before dinner.
Concentrated Essence : One-half to one teaspoonful two or three times a day in water.

FICUS DOLIARIA.—A peculiar form of anæmia, due to the presence of *Anchylostoma duodenale*, appears to have been long known in Brazil under the designation " intertropical *hypohæmia* ; " and a physician of Rio Janeiro, Dr. Moncorvo, states that the most effective treatment consists in the administration of the juice of *ficus Doliaria*, or *ficus gamellaria*. It is an old native remedy for the indigenous disease. Moncorvo is inclined to ascribe its drastic and vermifuge properties to the presence of doliarine, a sort of vegetable pepsine, analogous to, perhaps identical with, the papaine of Carica Papaya. This substance has already been administered with advantage to the St. Gothard sufferers (*Lancet*, 1882, p. 78).

GOA POWDER OR ARAROBA (*Andira Araroba*). Chrysophanic acid obtained from this drug is now used most successfully in psoriasis, ringworm and various skin diseases. This drug, as is well known, is very liable to vary in quality. That supplied by T. Christy & Co. is carefully prepared and packed, and will be found of very superior quality, and to contain the full percentage of Chrysophanic acid (see "New Commercial Plants and Drugs," No. VI.).

Preparations : Chrysophanic acid, and its ointment.
For formulæ, see " Pharm. Journal (3), *vol.* 7.

GO-SIU-JU (*Evodia Rutæcarpa*).—Considered by doctors of the Chinese school as a most valuable remedy, and is used as a purgative, emmenagogue, sudorific, and stimulant, in fact possesses properties very similar to those accredited to the common rue. (" New Commercial Plants and Drugs," No. IV., p. 50).

GRINDELIA ROBUSTA.—This remedy has become well established in America in cases of asthma and kindred diseases; in asthma and hay-fever 10 to 20 drops of the fluid extract may be given in sweetened water or milk every half-hour until relief is obtained.

PREPARATIONS: Fluid extract (1 dr. represents 1 oz. of the plant) and tincture.

DOSES: Fluid extract, ½ to 1 fluid drachm, repeated every three or four hours, as required.

Tincture, ½ drachm every one or two hours in whooping-cough.

GUACO (*Mikania Guaco*) has been introduced into this country as an important remedy for snake-bites, and its juice has been administered for intermittent fever, rheumatism, gout, hydrophobia, syphilis and cholera. (See "New Commercial Plants and Drugs," No. IV., p. 44).

PREPARATIONS: Fluid extract of the herb (1 oz. represents 1 oz. of the herb.

Doses: ½ to 1 fluid drachm.

GULANCHA (*Tinospora cordifolia*) is a useful agent in mild forms of intermittents, in general debility, after fevers and other exhausting diseases, and in secondary syphilitic affections, and chronic rheumatism (*Indian Pharmacopœia*, p. 9.)

PREPARATIONS: Tincture (Gulancha, cut small, 4 ozs., and proof sprit, 1 pint.)
Infusion (Gulancha, cut small, 1 oz., cold water, 10 fluid ozs.; macerate in covered vessel for two hours, and strain).
Extract: Gulancha, cut small and bruised, 1 pound to 4 pints of water.

DOSES: Tincture, 1 to 2 fluid drachms.
Infusion, 1 to 3 fluid ozs. three times daily.
Extract, 10 to 30 grains daily, in divided doses.

GYNOCARDIC ACID (*the active principle of Chaulmugra Oil*). This has been found by experience to be an excellent form for administering that drug.

Dr. Wyndham Cottle, Senior Assistant-Surgeon to the Hospital for Diseases of the Skin, in the *British Medical Journal*, June 25th, 1881, recommends the use of this acid in the shape of pills; he concludes with the following concerning the administration of the oil or acid:—

> The amount both of chaulmugra oil and gynocardic acid that individuals can take internally varies greatly. The oil, and the acid, in less degree, are both apt to produce nausea, and occasionally constipation. It is well to begin with a small dose, about four minims of the oil or half a grain of the acid, which should be taken after food twice or thrice daily, and gradually increased to half a drachm or a drachm of the oil, or one to three grains of the acid. An aperient should be given at the same time, if necessary. The oil may be enclosed in perles, which is the most agreeable mode of administering it if only a small dose be required; or it may be given in emulsion. It is convenient to have the gynocardic acid made into pills containing half a grain of the acid, with three grains of extract of gentian, extract of hops, or conserve of roses. To commence, one such pill may be given thrice daily. The amount may be gradually increased to two, three, or four pills for each dose. If larger quantities be required, it is then better to order pills containing from one to two grains of gynocardic acid.
>
> The chief advantages of gynocardic acid over chaulmugra oil, are, that, in using it, we are dealing with the active principle of the body, and a definite substance, rather

than with an uncertain mixture; its more certain and marked action; its lessened bulk; and the facility with which it can be administered in pills.

The constitutional effects of the drug may be obtained by the inunction on the skin of chaulmugra oil, or of gynocardic acid in the form of ointment. This is especially useful in the case of children. Gynocardic acid might be combined with a soap with advantage. I should expect such a soap to possess much of the soothing and remedial influence of the gynocardic acid, and that it would probably be useful in the treatment of many forms of skin disease.

Doses: In Leprosy, 3 grains daily.
In Psoriasis, Lichen-planus, Lichen-scrofulosum, and in some cases of relapsing prurigo, given internally as above, and an ointment of 25 grains of Gynocardic acid to an ounce of Vaseline, applied three or four times daily, afford great relief.

HÆMORRHAGE PLANT (*Aspilia latifolia*).—Used in West Africa to stop bleeding from both veins and arteries, and by Dr. Roberts, son of the late President of Liberia. This remarkable drug has not yet been used in this country (see *Pharmaceutical Journal*, January 19th, 1878, p. 563).

In Africa the bruised leaves are applied to the wound by the natives. The tincture and fluid extract deserve a trial. The decoction in the dose of 1½ ozs. three times a day is used in pulmonary hæmorrhage.

HAN-GE (*Pinellia tuberifera*).—According to Dr. Porter Smith, the powdered drug has an action like colchicum, and has been used for a long time in the Hankow Mission Hospital as a substitute for the sulphate of potash in Dover's powders. Although containing a quantity of starch, this drug is never attacked by insects, and might be worth a trial as an insecticide ("New Commercial Plants and Drugs," No. IV., p. 51.)

HOANG-NAN (*Strychnos Gautheriana*).—This drug has met with much success in cases of leprosy, and has been used in rabies, and is likely to come into permanent use (see "New Commercial Plants and Drugs," No. IV., p. 44).

The traveller, Abbé Lesserteur, gives an account of the cure in Tonquin of the bite of the black viper by means of this plant, and two cases of the cure of the bite of the *Cobra capella* in India; the bite of the cobra, he asserts, means simply death within half-an-hour.

M. Feron, a French missionary in India, who appears to have some experience of the new remedy, has written that a boy 17 years of age was bitten on the heel by a cobra. In a few minutes, the lad's leg swelled up as far as his thigh, and in less than ten minutes his sight was completely gone.

The first three pills restored his sight, and reduced the swelling of the leg to below the knee; two more reduced it to the sole of the foot. At the end of half-an-hour no pain was felt except that occasioned by the lesion of the *tendon Achilles*, and this pain disappeared as the wound proceeded to cicatrisation.

The following recipe is used in China:—

Preparations: Pills (for leprosy, Alum 1.5 gramme, Realgar 2.5 grammes, bark of Hoang-nan 2.5 grammes; reduce to powder and make pills of 25 centigrammes each.)

Doses · **In infectious ulcers, two to four pills of 25 centigrammes of powdered bark.**

HOLARRHENA ANTIDYSENTERICA.—The seeds of this plant have been used in India as a remedy for dysentery and hæmorrhage; and anthelmintic properties are also attributed to them (see "New Commercial Plants," No. IV., p. 27).

It has been found to be in no way inferior to the Cinchona alkaloids as an antiperiodic, and does not produce nausea, vomiting, or headache (*Lancet*, 1881, p. 887).

PREPARATIONS: Decoction of the bark, or preferably, infusion of the seeds.

DOSES: 2 to 5 grains of the seeds.

JAMAICA DOGWOOD (*Piscidia Erythrina*).—This new drug has proved a powerful narcotic, gives relief in uterine colic, spasms, sick headache, chordee and asthma. It has been successfully tried in toothache, &c., &c. (see "New Commercial Plants and Drugs," No. IV., p. 34).

PREPARATIONS: Tincture or fluid extract. The tincture is made by macerating 1 oz. of the powder in 4 fluid ozs. of rectified spirit for 24 hours.

DOSES: Of the tincture, 1 fluid drachm.
Of the fluid extract, 5 to 20 minims.

KAVA-KAVA (*Macropiper methysticum*).— This invaluable drug has been used in acute urethritis and vaginitis. It acts as a diuretic and blennostatic, and is a powerful tonic (see "New Commercial Plants and Drugs," Nos. IV. and VI.)

PREPARATIONS: Tincture and fluid extract of the root.

Infusion, 1 drachm in a quart of boiling distilled water; dose, 2 to 4 ozs. three or four times daily.

DOSE: Of the tincture 30 to 60 drops three times a day in a glass of water.

KUH-SHING, OR KUSAM.— This root, which has a remarkably bitter taste, is used in Japan as an anthelmintic, and, examined by Mons. Petit of Paris, was found to contain a well-defined bitter alkaloid, readily soluble in 10 parts of alcohol or 50 of water. It is not poisonous ("New Commercial Plants and Drugs," No. IV., p. 52.)

LYCOPODIUM (*Lycopodium clavatum*).— Experiments made with this tincture have shown that it posseses a special action on the urinary organs and liver, relieving spasmodic retention of urine in children and catarrh of the bladder in adults. The three great tracts of mucous membrane, with their cutaneous continuations, seem to be especially affected by it. Dr. Hutchinson found it quite a specific in some forms of dyspepsia. Dr. Bayes also speaks highly of it in constipation attended with flatulence, and in *enteritis* in infants, caused by taking food which they cannot digest. Mr. Pope says that in old hepatic congestions he has found Lycopodium more useful than any other medicine. Dr. Mayhoffer found it of great service in chronic passive bronchitis and in chronic pneumonia. Dr. R. Hughes has observed striking beneficial results in a caroted aneurism resulting during its use, the shooting pains disappearing in the first three days after taking it, and in a fortnight the enlargement of the artery was reduced one-half, at which point it remained stationary, giving no pain or inconvenience. But the use to which we particularly desire to call attention, is the remarkable action of this drug upon boils, carbuncles, and papular eruptions.

Lycopodium has hitherto been used in medicine chiefly as a dusting powder for excoriated surfaces, especially the *intertrigo* of infants, and to parts affected with erysipelas, herpetic ulcerations, eczema, &c.

Preparation: The tincture.

Doses: Ten drops in water twice a day.

MELALEUCA LEUCADENDRON (*M. lanceolata, R. Br.*)—We have just received a few pounds of this oil, which, like Cajeput, is very volatile; its vapour renders large insects insensible.

MENTHOL CRYSTALS (*Japanese Peppermint*).—This drug has proved most successful in neuralgia, sciatica, toothache and sunstroke. Mr. Malcolm Morris found Menthol most efficacious in ringworm when mixed with chloroform and oil. He states that in this way the remedy is more easily absorbed, and actually reaches and destroys the fungus in the hair follicles. Mr. Moruja, of Tohio, states that he has found in some samples of Menthol as much as 10.25 per cent. of crystallized sulphate of magnesia.

Dr. H. Nelson Hardy used a mixture of Menthol, Chloroform, and Chaulmugra Oil in Psoriasis, the patient deriving much benefit from the treatment (see " New Commercial Plants and Drugs," No. IV., p. 29).

A mixture of Menthol, Chloroform and Chaulmugra Oil is very useful in neuralgia and rheumatism as a local application.

According to *A New Idea*, a good formula for local application in neuralgia, would be:—Menthol, 4 parts; Alcohol, 140 parts; Glycerine, 10 parts; Oil of Cloves, 1 part; Oil of Cinnamon, 1 part; mix and paint the parts with a brush.

A. D. McDonald, in *Edinburgh Medical Journal*, thus speaks of Menthol:—

> As an anti-neuralgic, menthol is of great value. One-tenth to one-sixth of a grain of menthol steadies the contractions of an excited heart, and slows them to a comfortable speed, and at the same time produces slight cerebral drowsiness. Half a grain of the crystals produced vomiting from gastric irritation. The author does not advocate its internal use unless well diluted. He deals with menthol as a local anæsthetic. The application of oil of peppermint in facial neuralgia by the Chinese was practiced at a very early date. It has also been locally applied for gout, the relief in both affections being almost instantaneous. *A priori*, the author concludes that the oil cures in virtue of the menthol which it contains. Reference is made to seven cases. In the first case, tri-facial neuralgia, the affected tract was painted with a mixture of menthol, one grain; oil of cloves, ten minims; rectified spirit, fifty minims. This was done four times in successive attacks. Entire relief followed in from four to six minutes. First a feeling of coldness, and then some irritation from the application was experienced. This case may be regarded as typical; menthol is particularly advocated as a temporizing remedy until constitutional treatment may take effect. It may prove to be more effective as an application than aconite, veratria or atropia. Its use in toothache is followed by immediate relief. In neuralgia it has been noticed to render the paroxysms less frequent and less severe. In sciatica, the author painted the track of the sciatic, popliteal and tibial nerves to the ankle-joint with a 10 per cent. solution, and this gave the patient immediate relief.

A fresh supply has just arrived in splendid condition, and we are now in a position to supply all demands. These crystals are made by us into "cones," to apply to parts affected in neuralgia, toothache, &c.; the drug has also a great advantage over the ordinary peppermint oil for the manufacture of lozenges, as it is cheaper, by reason of being much stronger, possessing valuable antiseptic and anodyne properties.

Pages 97 to 104 are printed on Cream Wove.
Weight 38 lbs. per 500 Sheets Royal.

MUDAR BARK (*Calotropis gigantea*).—This drug is used by the natives as a remedy for epilepsy, paralysis, bites of poisonous animals, worms, &c. In cutaneous affections, especially leprosy, it is frequently employed. Its active principle, discovered by the late Dr. Duncan, of Edinburgh, called Mudarine, possesses the extraordinary property of congealing by heat and becoming again fluid when cooled. Dr. G. Playfair found the milky juice to be very efficacious in leprosy, lues venerea, herpes, dropsy, rheumatism, hectic and intermittent fevers; and Dr. Duncan considered that it agreed in many respects with ipecacuanha, and that it might eventually supersede the latter (see Major Heber Drury's "Useful Plants of India.")

Preparation : Powdered bark.

Dose : 5 to 6 grains twice a day, and a dose of castor oil if this produces nausea.

MYOCOM FLY GUM.—A piece of string or very thin stick wound round with a thread of Myocom Fly Gum and suspended from the ceiling will attract and catch every fly in the apartment; it will also catch wasps, mosquitos, &c. All chemists keep it.

NDILO SEEDS (*Calophyllum inophyllum*).— These seeds, according to Simmonds, contain nearly 60 per cent. of a fixed oil, which is used for medicinal purposes; it is considered a certain cure for itch. We have a supply of the oil expressed from the fresh seeds in India. In Travancore the natives use the leaves for sore eyes. The oil is also used for burning.

Preparations : The resin, the bark, and the oil from the seeds.

PAPAW (*Carica Papaya*).—This drug has been found to have the property of digesting living tissues, such as adenomata and cancers; and it has been proved to be an excellent remedy for the false membranes of croup, and diphtheria, and for worms (see "New Commercial Plants and Drugs," Nos. III., IV., V., and VI.)

Papaine has been used with great success in Germany by Prof. Rossbach and others in cases of diptheria, given in doses of 4 to 5 grammes. They also pencilled the throat with the preparation mixed with water (1.10).

Mr. Malcolm Morris has treated several cases of chronic Eczema with success by local application of the following liniment, viz. : Papaine, 12 grains; pulverised Borax, 5 grains, and water, 2 drachms; to be painted on the parts affected twice a day; the parts should also be washed with soap and water once a day, taking care, however, not to irritate the skin by rubbing. Mr. Malcolm Morris has also found this drug very useful for softening hard corns, and in cases of warts and psoriasis.

We find that the dry juice of Papaw contains about one-sixth of Papaine, so any one will be able to use the dry juice, should Papaine be found too expensive. Mr. Malcolm Morris is now testing the dry juice in a few cases, and we hope to be able to report his experiments in our next list.

Prof. Rossbach has ready for publication an important work on Papaw as a remedy for diphtheria, &c., &c., which will, no doubt, give the best information as to the administration and application of this important drug.

Preparations : Dry juice; Papaine; leaves; seeds; and liniment. (Papaine, 12 grains; Borax, pulverised, 5 grains; water, 2 drachms). To be applied with a brush.

PARAGUAY TEA (*Ilex Paraguayensis*).—Under the name of "Maté," the beverage made from this plant almost entirely replaces tea and coffee in South America. For an account of its uses and properties see "New Commercial Plants," No. III, and "New Remedies," January, 1878.

PREPARATION: Fluid extract of the leaves.

DOSES: ½ to 1 teaspoonful.

PEMMICAN.—This Pemmican, which has been specially prepared under the care of Dr. Bancroft, Brisbane, Queensland, makes a delicious and nutritive soup and beef-tea for invalids, as well as being invaluable to travellers, who may eat it with a little salt, no cooking being necessary. Four pounds of fresh meat are by this process reduced in weight to about one pound, none of the original nutritive value being lost.

Directions for use accompany every tin of Pemmican.

PERSIAN ROSE WATER.—This article, which is imported by us direct from Persia, is of an excellent quality, and is packed in curious native bottles, fit for counter exhibition. It has been found by ladies an excellent water for toilet purposes.

PISTACHIA GUM (*Pistachia Terebinthus*).—This gum has been lately tested as to its commercial value, and found an excellent substance for the manufacture of varnish. It is soluble in oil, turpentine, and alcohol; soda has no effect whatever upon it; it thickens very rapidly when left in contact with the open air, which renders it a valuable acquisition to painters on glass and porcelain. It being waterproof, it can be to advantage used for oilcloths, &c.

We are ready to supply this gum in large quantities at a very low price.

PITURI LEAVES.—This singular drug, which is chewed by the natives of Australia to excite them before fighting, has hitherto been exceedingly difficult to procure; but we are at length able to offer a limited quantity. Although its active principle has been stated to be identical with nicotine, it has not been proved that its effects are wholly due to that alkaloid.

In Australia, the natives, before any serious undertaking, chew the dried leaves, appearing to use about a tablespoonful.

Thirty drops of an infusion of 1 drachm of Pituri to 1 drachm of water, when injected under the skin of a half-grown cat, produced death from suffocation in one minute.

Pituri is given in cases of extreme debility, but Dr. Bancroft says it was given in too small doses to enable him to speak of its value, and he further states: "I would expect it to be a tonic nervine that could be used along with alcohol, æther, and ammonia; perhaps, also, with strychnia, to the action of which it has a great resemblance."

PLANTAGO ISPAGHULA.—The seeds of this plant have been long used in India as a tasteless but effectual cure for diarrhœa and chronic dysentery; they yield a mucilage more pleasant than the linseed for coughs and colds. It also cures diarrhœa in fowls (see "New Commercial Plants and Drugs," No. IV., p. 45).

DOSE: For an adult, 2½ drachms, mixed with water and sugar, and swallowed whole.

POMEGRANATE (Extract of)—From fresh bark of the roots of the white Pomegranate tree of Java.—This extract, which is made from the roots, and not from the Bark of the branches, has been successfully used both in Holland and Germany for tape-worm.

Preparation : Pills (8 grammes of the extract made into forty pills).

Doses : Five pills every quarter of an hour, and two hours after the forty pills have been taken, give two spoonfuls of castor oil.

PONGAMIA GLABRA OIL.—This oil is much esteemed in India as an application in scabies, herpes, and other cutaneous diseases; it is also used in rheumatism. Dr. Gibson states that he knows of no article of the vegetable kingdom possessed of more marked properties than this oil in the above cases.

We are having a supply of this over to test its value, and will then publish the results.

PYRETHRUM SEED.— A most valuable insect powder. The fumes of the burnt seed will kill or render inactive any flies or mosquitos; it has been found that all insects, more especially those of soft and delicate structure, are affected by the fumes. Extracts are also made from the Pyrethrum to apply to plants; it is most efficacious against worms, caterpillars, &c.

QUEBRACHO (*Aspidosperma Quebracho*). — This drug has proved itself wonderfully efficacious in diseases involving shortness of breath, such as emphysema, bronchitis, phthisis and pleuritis. Dr. Berckart speaks of it in high terms for dyspnœa (see "New Commercial Plants," Nos. IV. and V.)

In a late number of the *Annalen der Chemie*, Dr. O. Hesse gives an important paper on the Argentine Quebrachos. Dr. Hesse has obtained and described no less than six alkaloids from the *quebracho blanco* bark, viz.: aspidospermine (Fraude), aspidospermatine, aspidosamine, hypoquebrachine, quebrachine, and quebrachamine. (See "New Commercial Plants and Drugs," No. VI.)

Preparations : Fluid extract, the tincture, and alkaloids.

Doses : Fluid extract, 1 drachm.
Tincture, ½ to 2 drachms (1 part bark to 5 parts alcohol of 56°), macerated for eight days and filtered.

The compound tincture is made from Quebracho bark 2 parts, orange peel 1 part, alcohol 5 parts (56°). Aspidospermine, the alkaloid, can be dissolved in cod-liver oil in larger proportion than quinine. (See *Therapeutical Gazette*, August, 1880, p. 238, for formulæ.)

QUINCE SEED.—We are now in a position to execute orders for this article, which we are importing direct from the growers. The price varies, according to the supply and quality.

RUSOT (*Berberis Lycium*).—Extract of the bark; a remedy for ophthalmia which has been used in India from the earliest ages, and is now being tried in this country. The fruit of this plant, the "Zariçka" of the Persians, is used like raisins, and is believed to possess astringent, tonic, and cholagogue properties (see "Indian Pharmacopœia," p. 436).

The wood is believed to possess purgative, diaphoretic, and tonic properties. According to Dr. Wise, the following is the mode of application : Mix equal weights of Rusot and burnt alum, and half the weigh of opium, with lemon or lime juice, till the mixture has the consistence of cream, then apply round the eyelids and over the eyebrows of the affected organ, repeating the application twice in twenty-hours.

SASSY BARK (*Erythrophlœum Guineense*).—Dr. Lauder Brunton, in the *British Medical Journal*, March 29th and 31st, 1877, describes this bark as "a drug which strengthens and slows the heart, contracts the arterioles, and increases the urine." M.M. Sée and Bochefontaine found that Sassy possessed a remarkable action on the heart, almost identical with that of Homolle and Quevenne's Digitaline.

The following appeared in the *Lancet*, June 17th, 1882, viz.:—

> Gallois and Hardy obtained from the bark of a leguminous plant, the Erythrophleum guinense, an alkaloid which was alleged to have nearly the same properties as digitalin. This has been lately further investigated by Harnack, of Halle, who finds that the action of the alkaloid resembles the combined action of digitalin and picrotoxin. It has not only the same effect on the heart as the former, but, like the latter, causes convulsions by its action on the medulla oblongata. This is the more remarkable as only a few other bodies, and those non-nitrogenous, are known to produce either of these effects. Digitalin and picrotoxin are probably members of the same group, since the active constituents of digitalis yield, as Schmiedeberg has shown, peculiar products of decomposition, which have the properties of picrotoxin rather than of digitalis. Erythrophlein is also of interest in its chemical relations; it is readily decomposed, and when treated with acids or alkalies it furnishes to products a fluid base and a non-nitrogenous substance having the properties of an acid. The form of decomposition is analogous to that of atropin, which, under similar treatment, splits up into tropic acid and a base, tropin. Neither of the decomposition-products of erythrophlein has the action of the original substance. The acid body seems almost inert, while the action of the base resembles, although not very closely, that of nicotin and pyridin.

Preparation : The alkaloid Erythrophleïne.

SIDA RETUSA.—This herb is largely used by the natives of India in consumption and rheumatism. It is given as an infusion, and is said to promote perspiration, and the leaves are used as a poultice for snake bites, and in cases of the stings of wasps and other insects.

Sida retusa has been found, on examination, to contain a quantity of a mucilaginous substance, which no doubt accounts for its use in diseases of the chest.

SWEET PEPPER (*Capsicum tetragonum* var.)—This new variety of capsicum has all the delicate flavour of cayenne, without its irritating properties. It is invaluable as a stimulant for poultry, &c., and has been found to colour the feathers brightly when given to canaries.

TANNATE OF PELLETIERINE.—The alkaloid of the pomegranate is now coming into use in France and Germany as a remedy for tape-worm, in the treatment of which it has been found most efficacious. This salt is preferable to the sulphate, which attracts moisture.

Dose : 1½ grammes in a little water, and half an hour after give 1 to
1½ ozs. of castor oil.

TAYUYA (*Trianosperma ficifolia*) has been introduced as a new remedy for tertiary syphilis, and its active principle has been used in serious cases of dropsy, paralysis, obstinate cutaneous disorders, syphilis, &c. (see "New Commercial Plants and Drugs," No. IV., p. 41.) It is extensively used in Italy.

Preparations : Infusion, decoction, and tincture.

Doses : Infusion or decoction, 2 to 6 grains.
Tincture, 6 to 15 drops

TONG-PANG-CHONG (*Rhinacanthus communis*).— For Ringworm, &c. The *Wiener Med. Blatter* (1881, No. 27) gives an account of results obtained with the drug by Neumann, of Vienna. In chronic *eczema papulosum*, and in *herpes tonsurans vesiculosus*, daily applications of the tincture caused the characteristic features of the eruption to disappear in a fortnight, but the infiltration of the skin was uninfluenced. No prejudicial effects were observed. Neumann advises further experiments, but with a stronger preparation (see *Lancet*, 1881, p. 887, and 1882, p. 78, and "New Commercial Plants and Drugs," No. IV., p. 46.)

The fluid extract of the root is considered the best form of preparation.

ALKALOIDS, &c.

PETIT'S ESERINE, pure; Sulphate and Salicylate.
Do. DUBOISINE (Sulphate) in gramme tubes.
Do. PILOCARPINE (Nitrate) do. do.
Do. Do. (Hydrochlorate) do. do.
Do. Do. (pure) do. do.
Do. Do. (Sulphate) do. do.
Do. PELLETIERINE (Tannate of) the alkaloid of he Pomegranate.
Do. Do. (Sulphate of) do. do.
Do. QUININE (Bibromide of)
Do. CINCHONIDINE do.
} used in cases where the Sulphates produce headache and other unpleasant symptoms.
Do. CHRYSOPHANIC ACID, for psoriasis, ringworm, &c.
Do. PEPSINE (active); this preparation has been found the best in the market.
MERCK'S GYNOCARDIC ACID, the active principle of Chaulmugra Oil.
Do. PAPAYOTIN, or PAPAINE, the active principle of the Papaw.
Do. ERYTHROPHLEINE, the alkaloid of Sassy Bark.
Do. ASPIDOSPERMINE (pure) the alkaloid of Quebracho Bark.
Do. Do. (Citrate Crystals).
Do. Do. (Crystals).
Do. Do. (Powdered Sulphate).
Do. ESERINE, Pure Sulphate, Nitrate, Salicylate, and Tartras.
Do. PILOCARPINE (Nitrate).
Do. Do. (Hydrochlorate).

PONGAMIA GLABRA OIL.—We have just received a supply of this Oil, and have since learned that excellent results are being obtained in Bombay with it, especially in cases attended with itching.

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PEMMICAN,

OR

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IT MAKES DELICIOUS BEEF TEA, AND IS MUCH PRIZED IN SOME OF THE HOSPITALS.

THIS PEMMICAN, which has been specially prepared under the care of Dr. BANCROFT, Brisbane, Queensland, makes a delicious and nutritive Soup and Beef-Tea for Invalids, as well as being invaluable to Travellers, who may eat it with a little salt, no cooking being necessary.

We give extracts from letters received from persons who have tried PEMMICAN :—

From W. HOBBS, Esq., Visiting Surgeon, Brisbane :—

"My experience during the four months it has been used in the Department of the Brisbane Hospital under my charge, has convinced me that its use has been economical to the Institution, and also satisfactory to the inmates."

From G. D'OYLY H. ALPIN, Govt. Geologist for South Queensland :—

"It makes an excellent soup and mince, in flavour almost undistinguishable from that prepared from fresh beef; and the fact of its being dry, concentrated, and not the least liable to spoil, renders it particularly adapted to travellers."

From CHAS. GREY, Lieut. R.N.R., Com. of "Young Australia," 1868 :—

"I found it a most wholesome and nutritious food for children and invalids; and although exposed to different climates, it kept perfectly sound and good to the last."

From WILL. A. DIXON, Manager of Malden Island, South Pacific :—

"Gentlemen,—I have to thank you for the samples of Pemmican forwarded per '*Courier.*' I have tried it both in soup and in other ways, and find it fully comes up to the description in your prospectus, and have consequently recommended it to the attention of our firm in Melbourne."

From DANIEL E. ROLT, Commander of Ship "Young Australia" :—

"We, the undersigned passengers on board the ship '*Young Australia,*' from Moreton Bay to London, have much pleasure in bearing testimony to the value of Dr. Bancroft's Desiccated Beef, which was liberally issued to the children and invalids, and was much preferred to the condensed milk. Several of the children and two or three mothers were very delicate on leaving Brisbane, and found much benefit, and a great increase of strength and energy from the use of the Desiccated Beef made into soup and broth.

M. HOWARD, with two children.
ELLEN EDEN WEBSTER.
HELEN MITCHELL, with two children.
JANE M'CARTER, with three children.
JANE JAGGER, with three children.
MRS. MARY FINCH, with two children.

"The beef was also issued to the crew, and was very much liked; and, served in various forms, was also esteemed a very nice change by myself and saloon passengers, and should like to see it supplied to the Government emigrant ships."

Four pounds of fresh meat are by this process reduced in weight to about one pound, none of the original nutritive value being lost.

Price per lb. 4s., or in 5-lb. Tins at 18s. per Tin.

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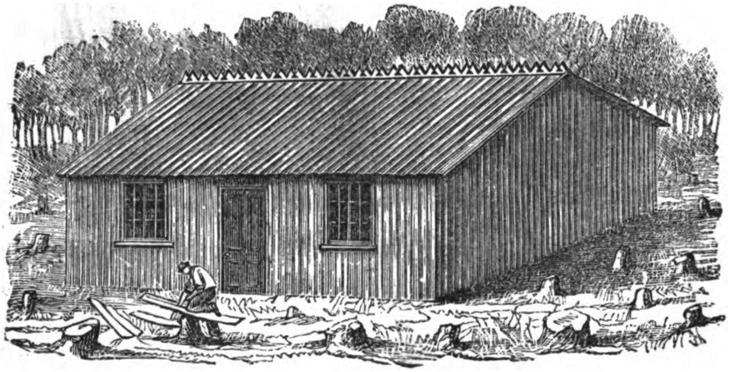

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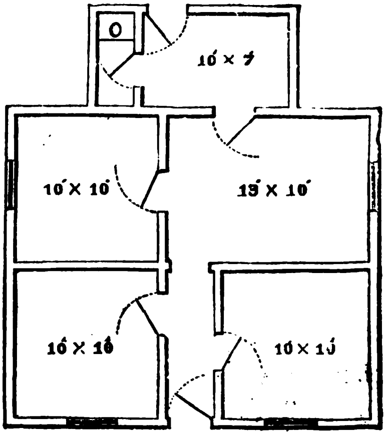

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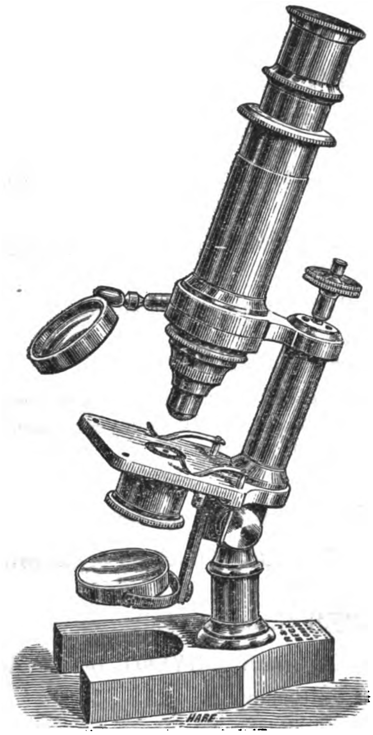

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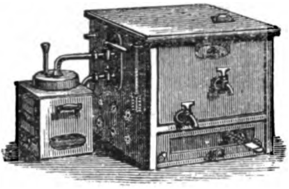

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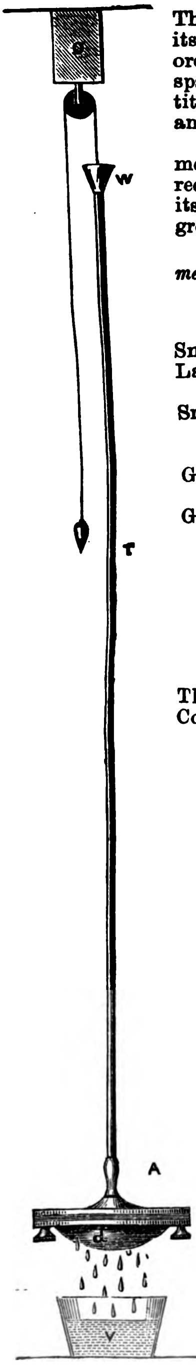

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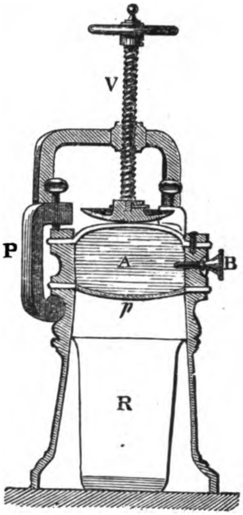

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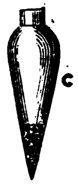

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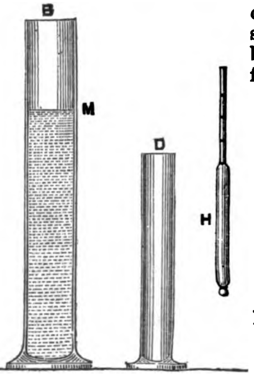

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ERRATA.

PAGE 36:—Under LEGUMINOSÆ:

Sida rhombifolia should be under MALVACEÆ (p. 33).

Sterculia acerifolia should be headed STERCULIACEÆ.

Muntingia calabura should be under TILIACEÆ (p. 35).

PAGE 55, line 14:—For *Paramaria* read *Parameria*.

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